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THE UNIVERSITY OF ALBERTA

A STUDY OF OVERINCLUSION AND UNDERINCLUSION ON THE PICTURE COMPLETION TEST OF THE WECHSLER ADULT INTELLIGENCE SCALE

A DISSERTATION

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ABSTRACT

The investigation was concerned with a study of overinclusion and underinclusion as measured by the Picture Completion Test of the Wechsler Adult Intelligence Scale. It was hypothesized that schizophrenic groups would make more failures and tend to overinclude more and underinclude less than normal, neurotic or psychopathic groups on the test.

The total sample of one hundred forty persons was made up of six groups. Group I consisted of forty normal staff members of the Provincial Mental Hospital. The remaining groups were made up of patients at the hospital. Group II consisted of pathological personalities of inadequate, antisocial and sexually deviant types. Group III was made up of psychoneurotics with either an anxiety state or reactive depression. Groups IV, V and VI were classified as schizophrenic, being of the catatonic, paranoid and undefined types respectively. The total sample contained seventy-seven males and sixty-three females. The groups were matched on a general group basis for age, intelligence and background.

The two statistical procedures used for an analysis of the data were a one-way analysis of variance by means of the F ratio and "t" test for the overinclusive data, and a nonparametric analysis of variance by ranks for the underinclusive data.

The hypotheses were partially confirmed. Schizophrenic groups made more errors than the other groups. All groups both overincluded and underincluded, and differences between groups appeared to be of a quantitative rather than qualitative nature. The catatonic and undefined schizophrenics overincluded significantly more than the normal, neurotic or psychopathic groups at the .001 level of significance, but also more than the paranoid schizophrenic group

which was found to underinclude significantly more than any of the other groups at the .02 level.

The results revealed that a high degree of both overinclusion and underinclusion appears to exist in schizophrenia, but that the great range of variability in performance with each of the six groups would prevent the Picture Completion test from being as valuable a diagnostic tool as had been anticipated.

Itwwas concluded that overinclusion and underinclusion are found in normal, neurotic, psychopathic, and schizophrenic groups, only becoming an aspect of disturbance when exaggerated in schizophrenia. A second conclusion arising from the results was that paranoid schizophrenics as a group tend toward underinclusion while catatonic and undefined schizophrenic groups tend to be overinclusive in problem-solving situations.

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Chapter I

INTRODUCTION

Disturbances in cognition have for sometime been a field of special interest to investigators of schizophrenia. In a recent publication R. W. Payne (1961) attempts to summarize those research findings which deal with abnormalities of cognitive function. He points out the difficulties encountered because of the fact that a basic comprehensive theory about normal cognitive processes does not as yet exist. Research has, nevertheless, shed some light on cognitive abnormalities through the study of problem-solving. Payne describes the following headings as all referring to aspects of thought which are known to be involved in solving cognitive tests: (a) Speed; (b) Persistence; (c) Error; (d) Distractibility; (e) Memory Span; (f) Learning; (g) Retention; (h) Drive; (i) Rigidity and (j) Concept Formation. Disturbances in concept formation are discussed under two subheadings: (1) Concreteness and (2) Overinclusion. The second type of disturbance, that of overinclusion, is the theme of the present study.

Payne defines a concept as some symbol, usually a word, used to denote a large number of stimuli. Since there are a variety of stimulus compounds, the concept often denotes an attribute common to many different objects or stimuli. Examples of such concepts would be "size", "weight", "color", etc. Thinking could be regarded as the internal manipulation of concepts, and in problem-solving the units of the problem itself with all their combinations would be concepts.

Most concept formation, in Payne's view and that of Lovibond (1954), can be regarded as a form of discrimination learning. For example, when a word is first heard in a certain context, it becomes associated with the entire situation or stimulus compound. As the word is heard again and again, only certain aspects of the stimulus compound are reinforced. Gradually the extraneous elements cease to evoke the response (the word), having become inhibited through lack of reinforcement. This inhibition actively suppresses a response which was formerly evoked by the stimulus. In this way new concepts are learned, through the inhibition of irrelevant stimuli.

Payne defines "concreteness" as an inability to formulate new concepts, or difficulty in making an abstract generalization. While many problems merely involve manipulation of concepts already learned, others involve a certain amount of induction, or the development of a new concept to denote some common aspect of the material. The "concrete" individual would thus be handicapped in many problem-solving situations.

On the other hand "overinclusion" is regarded as an extreme degree of stimulus generalization. Payne feels there is considerable evidence (to be covered in the survey of the literature) that schizophrenics do especially poorly at tests requiring inductive reasoning or the formation of an abstract generalization. He compares schizophrenics with normals, saying that normal people, when concentrating on one task, are able to ignore or are even quite unaware of irrelevant stimuli. It is as if some "filter mechanism" or mechanism of attention cuts out those external and internal stimuli which are irrelevant to the task at hand, allowing the most

efficient processing of incoming information. Payne believes that many schizophrenics behave as if this filter had lost some of its inhibitory properties and allowed irrelevant information to enter the processing mechanism. The schizophrenic then is no longer able to exclude the irrelevant. Selective perception is not observed. Thus overinclusive concepts are formed or learned. As the overinclusive disturbance becomes more severe, all concepts could become contaminated, all thought would then become more vague, and errors of reasoning would increase.

Cameron (1958) uses the term "overinclusion" in a wider sense, defining the disturbance as a defect of personality organization such that the individual cannot quickly eliminate from the repertory of responses associated with a certain object or stimulus those that are inappropriate for the given situation. In further describing this phenomenon Cameron (1946) speaks of the inability of schizophrenics to maintain the boundaries of the problem and to restrict their operations within its limits. All sorts of objects from outside are apparently brought into the situation. There appears to be a relative inability to exclude contradictory, competing, irrelevant, or remote material or stimuli. Disorganized schizophrenics, according to Cameron, frequently cannot adequately manage the essential first step in problem-solving, that of narrowing down one's operations to something restricted and unified enough to call out organized attitudes and specific responses. There is an inability to preserve conceptual boundaries. Ideas associated with or distantly related to concepts become incorporated into them, making them both more abstract and less precise.

In the solution of a problem the schizophrenic subject includes "such a variety of categories at one time that the specific problems become too extensive and too complex for a solution to be reached".[1]

Cameron (1947) quotes some of the comments of a schizophrenic subject when faced with an experimental task requiring the sorting of colored blocks of several shapes into a specific number of groups, in accordance with one principle of grouping.

> "I've got to pick it out of the whole room. I can't confine myself to this game"...."Three blues (test blocks) - now how about that green blotter? Put it in there too. (Green) peas you eat -- you can't eat them unless you write on it (pointing to the green blotter). Like that wrist watch (on experimenter's wrist) - I don't see any three meals coming off that watch" ...."White and blue (blocks) is Duke's Mixture. This (pulling out cigarette paper) is white. All this wood and Japan (producing match box). There's a man out there (on porch) with a white tie - that's got something to do with white suits"...."To do this trick you'd have to be made of wood. You've got a white shirt on - and the white blocks. You have to have them cut out of you! You've got a white shirt on - this (white hexagonal block) will hold you and never let you go - I've got a blue shirt on, but it can't be a blue shirt and still go together. And the room's got to be the same"....Considering the feasibility of grouping certain white and yellow blocks together, the patient asked, "Are there any Chinese working here?" (No.) "Only white ones -- then you can't put them together".[2]

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1 - Cameron (1939), p.266

2 - Cameron (1947), p.60

The above example of overinclusion clearly depicts the schizophrenic's difficulty in sorting out relevant from irrelevant stimuli in order to form appropriate concepts. He continues to respond to irrelevant stimuli which would not be attended to by the normal person, or at least not to such a degree.

In the survey of the literature (Chapter II) studies will be cited where support has been found for the hypothesis that overinclusion is found more frequently in schizophrenic concept formation than in that of normal, neurotic, psychopathic, brain damaged, senile or other psychotic groups.

Cameron (1958) also defines the opposite phenomenon of "overexclusion" or "underinclusion" in which the person so quickly and rigidly eliminates competing responses as to lose flexibility or adaptability to changing circumstances. Payne refers to underinclusion as the tendency to be abnormally restrictive in concept formation. Chapman and Taylor (1957) found no evidence for abnormal underinclusion in schizophrenic groups.

STATEMENT OF THE PROBLEM AND HYPOTHESES

It appears then that schizophrenics tend to overinclude more than do other groups. This abnormal concept formation when identified could be of value in the differential diagnosis of mental illness.

If overinclusion is as common in schizophrenic problem solving as studies would suggest, then it must appear from time to time during regular psychometric testing. The Picture Completion Test of the Wechsler Adult Intelligence Scale was selected as being one subtest where overinclusion would be likely to occur and

could be measured. The reason for the selection was that the Picture Completion test might provide ample opportunity for the expression of overinclusiveness. In each incompletely drawn picture there is a rich variety of stimulus features so that the subject, if he is so inclined, can pick out, respond to, or fail to exclude irrelevant, unessential stimuli or details. Again, the boundaries of each picture are fairly indefinite or vague. Here the subject may go outside the boundaries, including in the picture objects, events or situations that actually do not belong, or are irrelevant.

An attempt was made to measure the degree of over-inclusion in schizophrenic performance on the Picture Completion test. There was an assumption, of course, that this test could measure overinclusion. There was also an assumption that the test could bring forth underinclusive responses. This assumption was made on the grounds that the incompleted pictures would allow opportunity for the subject, if he were so inclined, to be abnormally restrictive in his concept formation. It seems likely that he could eliminate competing stimuli by, for example, failing to make any response at all.

At this point it is perhaps necessary to inquire into the rationale of the Picture Completion test itself. Rapaport (1945) considers the Wechsler-Bellevue Picture Completion test to be a test of visual concentration, where the discovery of inconsistency or consistency, that is, the appraisal of relationships, is an essential characteristic of concentration.

Wechsler (1958) is of the opinion that the W.A.I.S. Picture Completion test in a broad sense measures the ability of

the individual to differentiate essential from non-essential details, this being an important part of the individual's basic perceptual and conceptual abilities.

In a factorial analysis of the W.A.I.S. Picture Completion test Cohen (1956) found it to have a specificity of its own, extractable as a separate factor, which he was unable to interpret. It also showed the highest "g" loading of any of the Performance tests. Wechsler (1958) believes this new unique factor is a "relevance factor" important in intelligent behavior, i.e., the individual's ability to differentiate essential from non-essential details. Proof that such a relevance factor exists would validate further the choice of the test as a measure of overinclusion.

Payne (1961) draws attention to a study by Penrose (1945) in which schizophrenics obtained their worst scores on two tests which apparently involve inductive reasoning or the formation of abstract generalizations. These were the Picture Completion and Pictorial Absurdities tests. Rapaport and Wechsler also agree that schizophrenics are especially poor on these tasks. Payne feels that the poor performance is probably not due to the content of the tests, since other tests utilizing meaningful pictorial material are relatively well done, but rather due to the fact that the particular type of reasoning involved (inductive generalization) could be especially bad or abnormal in this group.

In view of the foregoing opinions regarding the rationale of the Picture Completion test, it does not seem unreasonable to assume that the test involves inductive reasoning and the ability to differentiate essential from non-essential details, and therefore may in fact measure the phenomenon of overinclusion.

Rapaport (1945) refers to a "loss of distance" sometimes seen in the schizophrenic subject's performance of the Wechsler Bellevue Picture Completion test. Here the subject considers as missing something which was not intended to be in the drawing. A chronic paranoid schizophrenic, with an otherwise well-retained front, said about the pig, (Item no.2) "No food in the pen". Another chronic unclassified schizophrenic said about the man without the shadow, (Item no.18) "The road is missing". Another schizophrenic said, "No crew on the ship" (Item no.14). An extreme form given only by very disorganized subjects, according to Rapaport, is to state of any profile that "the other eye is missing" (Item no.21). A mild, and even in normals, frequent abortive form of this type of failure is where the picture of the woman at the mirror (Item no.16) is responded to by naming missing parts which obviously were not intended to be drawn there. Other forms of this type of failure which sometimes serve as psychotic indicators are the responses pointing out minute gaps in the sketched lines or the undrawn bodies of heads as the missing parts.

In describing the specific types of Picture Completion responses Wechsler speaks of one which has no obvious relevancy to the immediate percept. The subject sees things which he thinks ought to belong but which are not actually called for by the sense of the picture. Wechsler describes such responses, e.g., "The hand is missing", to the Pitcher item, or "Bow is missing" to the Violin item, citing these as examples of bizarreness or confabulatory responses generally only elicited from schizophrenics. He lists further examples of deviant responses:

Item 1: Rest of the aeroplane

2: No food in the trough

4: No person in car

8: The person who is fiddling is missing

10: Filament is missing

11: The flagpole is missing

12: The leash is missing

13: The states aren't filled in

17: The man's wife not with him

18: No path

It does not seem unreasonable to assume that the above examples of "loss of distance", "confabulation", and "bizarreness" might also be described as overinclusion. They appear to satisfy Cameron's and Payne's definitions, and in this study such responses were labelled as being overinclusive.

The aim of this research was to determine whether or not schizophrenics tend to overinclude more than other groups on the Picture Completion test of the W.A.I.S. The problem may be stated in the following hypotheses:

(1) Failures on the W.A.I.S. Picture Completion test are more frequent in schizophrenic groups than in normal, neurotic or psychopathic groups.

(2) Analysis of these failures indicates that schizophrenic groups tend to overinclude more than do normal, neurotic or psychopathic groups.

(3) Analysis of these failures further indicates that schizophrenic groups tend to underinclude less than do normal, neurotic, or psychopathic groups.

Chapter II

Survey of the Literature

INTRODUCTION

Bellak (1958) states, "The language and thinking process in schizophrenia have been the focus of widespread interest among psychiatrists and psychologists since the published observations of Kraeplin and Bleuler ... If one were to condense all the viewpoints into a single sentence, it might be said that the language and thinking of schizophrenics have either been depicted as representing a deficit (e.g., a deficit in conceptual thinking) or a type of disturbance (e.g., over-inclusion, paleological thinking)".[1]

The chapter will begin with the consideration of "deficit" versus "disturbance" viewpoints, dealing briefly with studies of the hypotheses of concrete and abstract concept formation in schizophrenia. The second and third parts will present a detailed review of literature relating to the present study. Finally there will be a review of theoretical formulations which also pertain to the study.

Literature and Studies of Concreteness of Thinking or Deficit in Conceptual Thinking

The earliest studies of concreteness of thinking were carried out by Goldstein and his followers. Goldstein (1946) feels that concreteness is characteristic of schizophrenic thinking and behavior. The schizophrenic is governed by outer-world stimuli which correspond to his own images, ideas, and thoughts, or his own realm of reality, experiencing only objects to which

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1 - Bellak (1958), p.230

he can react in this concrete way. He is bound to reality as he experiences it, and does not consider an object as part of an ordered world separated from himself. Goldstein agrees with Storch (1924) that schizophrenics because of organically determined impairment have regressed to a lower evolutionary level where symbolic thinking is damaged and the changed world is void of abstract interpretation.

Goldstein (1939), Goldstein and Sheerer (1941) and Vigotsky (1934), using sorting techniques, found the concrete attitude to be common to both schizophrenic and brain-damaged populations. Goldstein and Scheerer identify "concreteness" and "rigidity", maintaining that people who have difficulty in making an abstract generalization are rigid in that, having once produced one type of abstract classification, they have difficulty in producing an alternative generalization for the same material.

Vigotsky's theory of schizophrenic concreteness deals with a regression to a more primitive level of "thinking in complexes" where objects are not viewed under general concepts, but are seen merely as individuals. When they form groups these groups are concrete complexes and not classes determined by concepts.

Kasanin (1946) feels that the schizophrenic thinks in more concrete, realistic terms, not being able to grasp the idea of classification according to certain principles. He frequently develops other categories than those of the average person, classifying material under purely physiognomic aspects. Being unable to abstract one principle while neglecting the other, he takes all the possibilities into simultaneous consideration making a tremendous

variability quite different from the concreteness of organic cases. Kasanin and Hanfmann and Kasanin (1939), (1942), found that not all adult normals possess a high level of conceptual thinking, and that some schizophrenics were free from defect while others failed to group as do normals, substituting instead broad unusual principles of classification which were difficult to analyze. There findings were confirmed by Rapaport et al (1945), Rashkis, Cushman and Landis (1946), and Feldman and Drasgow (1951).

McGaughran and Moran (1956), (1957), scored the sorting behavior of schizophrenics along two dimensions: (a) "open-closed", or concrete-abstract concepts, and (b) "public-private", or usual-unusual concepts. Far from being "concrete", schizophrenics formed slightly more extensive and unusual concepts. The results were interpreted as demonstrating a loss of social communication in schizophrenia, in support of Cameron's (1946) and Sullivan's (1946) views.

Another approach to schizophrenic concept formation and the concrete-abstract hypothesis is through the use of proverbs, such as Benjamin's test. Benjamin (1946) found what he called a high degree of literalness of schizophrenic thinking, in support of the concrete hypothesis. As well as giving literal meanings for the proverbs, the patients who succeeded in getting away from the literal meaning often failed to return to the literal when it was called for. Gorham (1956) and Flavell (1956) found further evidence for the concrete hypothesis.

Payne, Mattussek and George (1959) suggest that the studies of "concreteness" have not succeeded in demonstrating that schizophrenics are unable to make abstract generalizations.

They point out that some of the poor scores made by schizophrenics on concept formation tests may be more a function of speed rather than an inability to form abstract concepts. They note also that the sorting test and proverbs test scoring methods make no distinction between what might be called a "bizarre" or unusual sorting and a failure to sort at all. Abstract but unusual and overinclusive responses could be incorrectly rated.

Arieti's theoretical formulations (1959) may represent a compromise between the two aspects of the concrete versus abstract hypothesis. Arieti states that in different patients we see all the possible transitional stages from abstract feeling to concretization of the concept. This process involves in addition to Goldstein's conception of withdrawal from the abstract into the concrete, a process of active concretization. The schizophrenic not only loses the abstract, he transforms the abstract into the concrete. The abstract level is impaired but not completely lost. Feelings which cannot be sustained or coped with in the impaired abstract level are immediately channelled into lower levels where they acquire a different representation.

While the above studies show rather conflicting results, the evidence appears to be more convincing that schizophrenics, or at least some schizophrenics, are able to formulate abstract concepts or generalizations, and the nature of these are such that they tend to be unusual or bizarre. The abstract hypothesis appears to be more in keeping with the theories of overinclusion, since it allows for broad, unusual principles of classification containing irrelevant, unessential or only distantly related concepts.

Literature and Studies of Overinclusive Concept Formation

Cameron was one of the first to explain much of the thought disorder in schizophrenia in terms of overinclusive concept formation, although Schilder, Bychowski, Angyal and others have described a similar type of disturbance.

Cameron appears to have been the originator of the word "overinclusion". (His definitions have been outlined in the Introduction). Cameron (1938), (1939) administered incomplete sentences and a sorting test to groups of schizophrenics, seniles, normal children and adults. He concluded that the organization of thought in the schizophrenic group, unlike that of the other groups, was characterized by an inability to maintain adequate boundaries in order to keep conflicting and irrelevant elements from intruding into the task. Extraneous, absent and past material was overincluded in the task. The schizophrenics were versatile and flexible, although unsuccessful, including such a variety of categories at one time that the specific problems became too extensive and too complex for a solution to be reached. Their thought was distracted as well by the interpenetration of personal themes.

Cameron and Magaret (1951) suggest that in overinclusion the generalization of reactions is extended until the individual cannot maintain boundaries between the various behavioral sequences or fields in which he participates. Because of the schizophrenic's unstable behavior organization he is unable to limit the number and kind of effective excitants or stimuli to a relatively few coherent ones to which he can respond in an adequate manner. As a result he may respond to many successive and simultaneous

stimulations. His failure in limitation causes contradictory, competing and more or less irrelevant responses to be included in his developing or ongoing act, making further behavioral disorganization inevitable.

Cameron's first definition of overinclusion, developed operationally in connection with sorting behavior, has been expanded to cover a wide range of behavioral disorganization. However, his early definition is useful for the present research, particularly the description of the schizophrenic's inability to maintain adequate boundaries, with the result that irrelevant, extraneous, absent and past material is overincluded in the task. The W.A.I.S. Picture Completion test with its many stimulus features and indefinite boundaries would provide an opportunity for this type of overinclusion to take place.

The most pertinent studies would probably be those involving a study of overinclusion in picture completion tasks. Unfortunately, most of the research has been concerned with sorting tasks and proverbs. Hanfmann (1939) reports a study using the Healy Picture Completion Test. Several types of peculiar completions were noted. The explanations given by the patient could often be extremely far-fetched or even totally irrelevant. In most cases a definite connection between the inserted object and the represented scene seemed to exist in the mind of the patient, yet he was unable to make this connection clear to the examiner. Objects loosely belonging to the same sphere as the situation represented in the picture or some part of it, and objects symbolically representing the situation were inserted. One patient placed a book in a group of boys and explained,

"On account of the boy having a T on his sweater, I figured that a book would go in". Generally the schizophrenic seemed unable to keep apart the sphere of personal wishes or fears and the sphere of objective reality. Occasionally the pictures seemed to be given momentarily the status of reality together with some personal meaning and then completed in accordance with the subject's fears or desires. Hanfmann attributes most of the errors to the general ineffectiveness of all system-forming factors which he feels is characteristic of schizophrenic thinking. While he does not use the term, it seems reasonable to assume that many of the incongruous placements of the schizophrenics could be classed as being "overinclusive".

Balken (1943) administered ten of Murray's T.A.T. pictures to seventy-five schizophrenics. She found that the patients were able to generalize, but the generalizations were unusual, with interpenetration of personal preoccupations and inability to maintain adherence to those aspects of the directions which they had accepted. The resulting stories were characterized by lack of causal connections, by juxtaposition of items which appeared unrelated, diffuseness, scattering and spread of meaning. She comments on the schizophrenics' failure to integrate material toward an end which had been externally imposed by the test situation and only dimly apprehended because of the influence of diverse stimuli.

Shneidman (1948) investigated psycho-social aspects of fantasy productions in fifty normals and fifty paranoid schizophrenics, using the Make a Picture Story Test. The schizophrenics

showed spontaneous self-identification, often being unable to distinguish between themselves and other real people on the one hand and the test figures on the other, behaving toward the figures as though they were real persons. Shneidman says this is similar to Balken's findings of interpenetration of personal preoccupation. The schizophrenics demonstrated a high degree of overinclusion by overpopulating the background with many figures and often using more than one background for an elaborate, moralistic story. They seemed unable to maintain the boundaries of the problems.

The picture completion test studies cited in the literature, although few, point out clearly that pictures, particularly those involving diverse stimuli and fairly unstructured situations and boundaries, provide a very fruitful area for the study of overinclusion. Such tasks require that the subject be able to sort out relevant from irrelevant stimuli or details and then go on to integrate the material in a meaningful way toward an end. At the same time they provide opportunity for overinclusion to occur if the subject is prone for some reason, to being unduly influenced by or unable to sort out irrelevant stimuli. The subject can not only respond to irrelevant details that are present, but he can also bring outside, distantly related or past material into the picture. For this reason the picture completion tasks are considered by the writer to be better measures of overinclusion than are the sorting tasks.

Zaslow (1950) developed a card test of overinclusion in concept formation, Card One depicting an equilateral triangle, Card Fourteen a perfect circle, and the intervening shapes

gradually changing from a triangle to a circle. The test was administered to twenty-four schizophrenics and sixteen control persons. Four methods were used to determine how many cards the subject would incorporate into the concepts "triangle" and "circle". Zaslow found that thirty-seven percent of the schizophrenics were underinclusive or constricted in their conceptualization. In his opinion this restricted conceptual grouping is a sign of rigidity or concreteness. On the other hand, forty-six percent of the schizophrenics showed looseness of conceptual span, permitting the triangular and circular concepts to overlap. This group showed direct interpenetration by actually breaking the boundaries previously established and overincluding essentially dissimilar objects. Zaslow considers the expanded conceptual grouping to be a sign of fluidity. He supports Angyal's contention that schizophrenic thinking shows impairment of system connections rather than relationships. Kugelmass and Foundeur (1954), however, failed to confirm Zaslow's results at an acceptable level of significance.

Epstein (1953) developed another test of overinclusion, consisting of fifty stimulus words, each followed by six response words including the word "none". The subject is asked to underline every word which he considers to be an essential part of the concept denoted by the stimulus word. The test was administered to twenty normals and twenty male and twenty-five female schizophrenics of various subtypes. The results revealed a significant degree of overinclusion among the schizophrenics. Analysis suggested that the greater the personality disorganization the greater the overinclusion. There were no differences

between the schizophrenic and control groups in mean underinclusion. While the controls made about an equal number of overinclusion and underinclusion scores, schizophrenics made almost twice as many overinclusion as underinclusion scores. Neither men nor women appeared to differ to any degree on overinclusion nor was it influenced by vocabulary. A study of the actual responses themselves showed that the schizophrenics tended to overinclude stimuli which were but associationistically or concretely related to the task at hand.

Epstein's findings were supported by Moran (1953) in a study using a vocabulary, synonym and neologism test, by Daston, King and Armitage (1953) and by Lovibond (1954), Lovibond employed an elaborate rating system to assess the amount of overinclusion on the Goldstein Object Sorting Test.

Chapman (1956) investigated a group of forty schizophrenics and twenty-five normals. His test consisted of series of similar response cards which were to be grouped with relevant stimulus cards according to groupings such as "fruit", "tools" etc. Distractor items such as Arabic numerals were inserted on some cards. The results were as predicted in that errors in the schizophrenic group were produced by distractor items. However, Chapman noted that some schizophrenics were able to perform as well as normals.

A similar study by Chapman and Taylor (1957) involved cards which were to be sorted according to a concept (e.g. "fruit"). Distractor items were added, some similar but incorrect, and others quite different. The test was administered to twenty-four mildly disturbed schizophrenics, twenty-four severely disturbed

schizophrenics and twenty-four normals. The schizophrenics over-included significantly by including the similar with the correct items, according to a broader category than was specified by the instructions. The more severely incapacitated group tended to make more errors. There was no abnormal underinclusion in the schizophrenic groups. Chapman and Taylor support the contention that schizophrenic inferiority on conceptual tasks is due to over-responsiveness to inappropriate stimuli rather than loss of conceptual ability.

It appears then that the presence of distractors may be useful in bringing forth overinclusion errors. The W.A.I.S. Picture Completion Test, in the writer's opinion, provides distractors. For example, Item 20 presents a picture of a woodpile with snow missing. Other details in the picture which could very well serve as distractors are a barn, doors and windows, a silo, a weathervane, and a fence.

Some of the more recent studies of overinclusion have attempted to investigate differences in the degree of overinclusion among various subtypes of schizophrenia. Zaslow (1950) notes that there may be important differences between paranoid and non-paranoid types and between process and reactive schizophrenics. Feinberg and Garman (1961) found more overinclusion in acute than chronic schizophrenics.

Payne and Hirst (1957) studied overinclusion in depressives and normals by means of the Epstein test. The results indicated that depressives overinclude to a significantly greater amount than do normals. Payne and Hirst concluded that over-inclusion may be related to the specific symptom of depression.

Payne and Hewlett (to be published) found overinclusion in both psychotics and depressives.

A series of studies by Payne, Matussek and George (1959) and Payne and Hewlett (to be published) present striking evidence in support of the theory that overinclusion is a fundamental aspect of schizophrenic thought disorder. A large battery of tests were given to investigate intellectual speed, motor speed, concreteness and overinclusion in normals, neurotics, depressives and schizophrenics. There was no evidence that schizophrenics are unable to generalize; in the sorting tests they produced almost twice as many different methods of sorting as did other groups. Payne and Hewlett factor analyzed the tests for the combined group of subjects. A factor labelled "retardation" significantly differentiated between the combined normal and neurotic groups and the combined psychotic groups. Both schizophrenics and depressives were equally retarded. The factor of general retardation was found to be correlated with a factor labelled "overinclusive thinking". This was consistent with the hypothesis that abnormal slowness in schizophrenia is partly the result of this type of thought disorder. However, it was demonstrated that overinclusion could not entirely account for all the retardation shown by the schizophrenic group and could account for none of the retardation shown by the depressives. The endogenous depressives were abnormally retarded but not overinclusive. It was concluded that in a psychotic group abnormal slowness has at least two causes.

As predicted the factor analysis showed that concreteness ratings were loaded on a factor labelled "overinclusive

thinking". Factor scores showed the schizophrenics to be abnormally overinclusive as compared with the other groups. Further analysis showed that only one-half of the schizophrenics were abnormally overinclusive. Their scores were extremely heterogeneous, ranging from the most normal scores to the most abnormal obtained. Payne and Hewlett concluded that there probably are two groups of schizophrenics. One resembles the endogenous depressives in that it is not abnormally overinclusive. These subjects appear to be abnormally retarded and might show catatonic features and inappropriate affect. The second group appears to be quite unlike depressives in that these schizophrenics suffer from an abnormal degree of overinclusion. Their speed scores were normal. Payne and Hewlett speculate that these patients may have paranoid delusions and ideas of reference. Both these symptoms could be unwarranted generalizations from the facts, as perceiving facts where none exist or which most people would judge to be irrelevant. The two most overinclusive individuals in the group had been diagnosed as paranoid schizophrenic. However, these findings are not in keeping with those of Wittenborn and Holzberg (1951 b) who report that schizophrenics with persecutory ideas and delusions tend to be significantly slower.

There is some suggestion from the survey of the literature that schizophrenics as a group are heterogeneous, with errors ranging all the way from underinclusiveness to overinclusiveness. There may be differences between acute and chronic schizophrenics, or between paranoid and non-paranoid schizophrenics. The findings in this area are rather conflicting. It would likely be worthwhile in any further research to divide schizophrenic groups either by severity, length, or type of illness. The research to be

reported in this paper divided schizophrenic groups according to types of illness.

The literature does not present any evidence for qualitative differences between the overinclusion seen in normal, neurotic, depressive, and schizophrenic groups. Schizophrenic overinclusion does not seem to be abnormal, unusual or bizarre, and differs from normal overinclusion in degree or quantity rather than in kind.

There was some evidence from the studies by Payne et al (1957), (1959), (1961), that some schizophrenics have difficulty in adhering to new concepts when asked to employ them over a period of time. Rodnick and Shakow (1940), in a study of reaction time found schizophrenics to be more defective than normals in maintaining an appropriate level of mental preparedness or set. Although schizophrenics were able to maintain a comparatively high preparatory set they were often unable to hold it under conditions where distraction was present. Fey (1951) reports similar findings. Her schizophrenics showed no deficit in initial learning but experienced difficulty in holding the correct set when once having achieved it, they were asked to adhere to it over a period of time. Tizard and Venables (1956) obtained similar results. Rodnick and Shakow noted a consistent trend for paranoid schizophrenics to behave most like normal subjects, while catatonics appeared to show the most deficit.

Payne and Hewlett (to be published) found that schizophrenics showed an abnormal amount of adaptive flexibility, being less rigid than normals following the establishment of a set on the Luchins test of Einstellung rigidity.

Payne (1961) states that many authors consider the difficulties in learning shown by schizophrenic patients to be secondary to more fundamental abnormalities of attention, cooperation or motivation. Hunt and Cofer (1944) consider that the deficit in schizophrenia is one of motivation rather than capacity. Payne says it seems likely that the importance of the effect of distraction on the cognitive test performance of abnormal subjects has been underestimated. Hall and Crookes (1951) in an experiment involving the learning of verbal and motor tasks comment on schizophrenics' performance being suggestive of increased competition from previously learned responses. Shapiro and Nelson (1955) were able to demonstrate that acute schizophrenics show less learning impairment than do chronic patients.

Jones (1961) reviews the studies concerned with learning in psychotics and concludes that while research has disclosed many promising leads, there are too many inconsistent and isolated trends as yet to merit any unifying theory. However, she feels that there is sufficient consistency within groups of findings to conclude tentatively that psychotic patients of all types are capable of learning. At the same time some psychotics display impaired learning efficiency, with considerable individual differences. Such impairment may in fact be a secondary effect of motivational or other processes. Schizophrenics do not form a unitary group, and paranoid schizophrenics display specific tendencies. While some types of schizophrenia may result in exaggerated inhibitory tendencies, others may be characterized by increased stimulus generalization. Chronicity and severity of psychosis are in Jones' opinion related to the degree of learning impairment.

Some studies have enquired into a possible relationship between the amount of overinclusion and social concept problems. Cameron's view that the essence of schizophrenic thought disorder is social disarticulation leads to the further hypothesis that the impaired thinking of schizophrenics would be more clearly disclosed when they must deal with socially toned material than with relatively neutral or non-social material. Whiteman (1954) found schizophrenics to be more deficient on social concept problems than on formal concept problems. These findings were confirmed by Flavell (1956) and Bernstein (1960).

In general, the studies of overinclusion show rather consistently that schizophrenics overinclude more than do other groups, although the nature of the process is not known. There appears to be a good deal of evidence that most schizophrenics can generalize and form abstract concepts, although not all schizophrenics do so. There is also evidence that the subtypes may differ in performance, varying all the way from underinclusion to overinclusion. Variability in performance and between subtypes was therefore anticipated in the writer's research, but the direction such variability would take was unknown because of the inconsistent findings cited in the literature.

Literature and Studies of Underinclusive or Overexclusive Concept Formation

Cameron (1939) was probably the first to define underinclusion, which he called "overexclusion", or the opposite phenomenon to overinclusion. This situation, according to Cameron and Margaret (1951) occurs when one's "anticipant attitudes" are so tightly organized that specific reaction-sensitivity to a narrow

range of stimulation becomes high. This behavior can be found in dreaming, deep preoccupation, and delusion. Another example would be failure to recall familiar events and names. Overexclusion, Cameron believes, is typically found in cases of hysterical inactivation or hysterical forgetting, developing in relation to the patient's own need. It is resorted to in an attempt to preserve or achieve stability.

Payne (1961) defines underinclusion as the tendency to be abnormally restrictive in concept formation. Balken (1943) and Shneidman (1948) noted this tendency in the stories of some schizophrenics. White (1949) and Zaslow (1950) also found evidence of underinclusiveness in schizophrenic subjects' conceptualization.

Epstein (1953), Chapman and Taylor (1957) and Payne and Hirst (1957) found no evidence of abnormal underinclusion among schizophrenic subjects. Epstein speculates that underinclusion when it occurs among schizophrenics is a reaction formation to a more basic tendency in an attempt to ward off disorganization. This would be also in line with reports on the use of rigidity as a defense mechanism.

Feinberg and Garman (1961) found that chronic schizophrenics compared with acute schizophrenics tended toward underinclusiveness in their tendency to restrict the number of items considered similar. There appeared to be a steep generalization gradient, in contrast to studies such as that of Mednick (1958) who postulates that schizophrenia is characterized by a flattening of the generalization gradient, and that it is more pronounced in chronic than in acute schizophrenia. DeMille (1959) argues strongly against the acceptance of an abnormally flattened generalization

gradient. Payne (1961) comments that no attempt appears to have been made to formally investigate the relationship between specific tests of overinclusion and underinclusion and a stimulus generalization gradient.

Raush (1952) and Winder (1960) found support for the hypothesis that paranoid schizophrenics manifest overconstancy and increased awareness of and sensitivity to events in the environment. Winder suggests that psychotics who are still making an adaptation must do so by excessive control or underinclusion.

Fisher (1950) studied rigidity levels of paranoid schizophrenics, conversion hysterics and normals, finding that in general paranoids and hysterics were more rigid than normals. He also noted a variability in rigidity, even in the same subject, concluding that there are at least two roughly defined rigidity levels in any given personality -- an ego level and a peripheral level. He comments that paranoid schizophrenics with both outer and inner defenses have a set to deal with situations in terms of minimum involvement. Other paranoid schizophrenics may be particularly vulnerable to disturbing stimuli. These findings are confirmed by Zucker (1958).

The few investigations relating to underinclusion that have been carried out have produced rather conflicting results. Studies by Shneidman, (1948) Kugelmass and Fondeur (1954), and Daston, King and Armitage (1953), where the majority of subjects were paranoid schizophrenics, stress the tendency of paranoids to be overinclusive. On the other hand, studies by Fisher (1950), Raush (1952), Winder (1960) and Zucker (1958) present evidence to the contrary. Further investigations will be necessary in order to

establish whether or not schizophrenics may at times be underinclusive, and whether there may be a significant difference in underinclusiveness among the various subtypes.

Some degree of underinclusiveness was expected to occur on the W.A.I.S. Picture Completion Test because of the variability of performance for all types of subjects. To what extent it might occur in any particular group of subjects was not predicted with any degree of certainty. However, the writer felt that if schizophrenic groups tended to make a great many more overinclusion errors than did other groups, then they would likely make fewer underinclusion errors than the other groups. Despite the variability in schizophrenic performance, the writer felt that errors would in general tend to follow one direction, that of overinclusion.

Theoretical Formulations Related to Overinclusive Concept Formation

In this section two types of theoretical formulations in the literature will be presented; the first dealing with the development of overinclusive disturbance and the second with the actual process itself.

Cameron (1938 b), (1946), regards disorganization in schizophrenic thinking as a symptom of "social disarticulation". He views schizophrenics as persons who have never developed adequate role-taking skills, and have therefore not been able to establish themselves firmly in their cultural pattern. In the face of emotional conflict they find themselves unable to resist a progressive withdrawal from participation into a fantasy life resulting in a gradual impairment in organized , socially acceptable thinking. Both Cameron (1946) and Sullivan (1946) stress the importance of social

communication as depending upon the ability to see that instruments of communication are mutually understood while being used. The person must be able to define and limit his terms by discarding what is unimportant or irrelevant. This capacity is absent in schizophrenic disorganization.

Sullivan (1946 b) and Arieti (1959) believe that the attitudes of the parents toward the child are important since the "self" of the child is built from "reflected appraisals" which come from the parents. In the family of schizophrenics an atmosphere of anxiety prevails, causing an absence of a state of satisfaction or security for the child. It becomes difficult for him to introject the symbolic world of the others so that he can as a result of their reflected approvals get a feeling of trust in himself and thereby attain a stable self-image.

The beginning of the schizophrenic cleavage lies in the never completely accepted social self, that part of the self originating from others. Conflict between the "good me", "bad me and "not me" arises from a basic inconsistency on the part of the parents who alternate between hostility and love toward the child. Bateson (1958) speaks of this "double-bind" type of communication where the future patient receives a message with two or more meanings so related to each other as to induce painful conflict and confusion.

Theories of ego development such as those advanced by Piaget (1932) and Federn (1949) indicate that the first stages of infancy are characterized by a lack of differentiation between the self and the outside world. The development of a differentiated ego comes about through a process of selection and inhibition of incoming sensory stimuli. Perception is finally stabilized by one's

capacity to adequately interpret the flow of information reaching him; this is done as the ego gains increasing mastery over its environment.

Federn (1949) and Bychowski (1952) hypothesize that in the schizophrenic the boundaries between the ego and id as well as between the ego and the outside world are inadequately cathected. Thus elements from the periphery may break in and overwhelm the person with a host of unrelated experiences or external stimuli. Bychowski speaks of the "fluidity of ego boundaries", pointing out that for this reason many schizophrenics are too suggestible, too easily swayed by stimuli in external reality. Zucker (1958) believes that in this sense the concept of impaired or fluid ego boundaries is in keeping with Cameron's discussion of overinclusion. McGhie and Chapman (1961) support this hypothesis on the basis of material collected from clinical interviews with early schizophrenic patients.

Zucker speaks of the schizophrenic ego being exposed to the impact of excessive stimulation or impressions which the ego is unable to screen out or select. There is a definite impairment in the selection process.

Zucker (1958) gave the Rorschach, Mosaic and Figure Drawing tests to ambulatory and hospitalized paranoid schizophrenics. The greatest fluidity was seen in the hospitalized group.

Angyal (1946), Kasanin (1946), and Goldstein (1946) agree that the schizophrenic's impaired ego boundaries are reflected in his inability to maintain adequate boundaries between ego and non-ego, background and figure, reality and unreality and between what is essential or relevant in a given situation and what is not.

Hanfmann (1942) and Angyal (1946) explain schizophrenic thinking disturbance as a form of faulty integration or a general ineffectiveness of all system-forming factors. Because of his failure to apprehend system connections the schizophrenic drifts from one realm to another, not separating fact and fancy and allowing interpenetrations to occur, bringing together incongruous elements with only fleeting connections. Balken's (1943) findings confirmed the hypothesis.

Schilder's view (1954) is that conscious thinking has a goal toward which clear and relevant thoughts progress, surrounded by a fringe of less important, less precise ideas and recollections which accompanies the main train of thoughts. The schizophrenic individual is unable to focus his attention on the center; associated ideas from the fringe constantly interfere with the clearness of his thinking.

Winder (1960) reasons that if overinclusion is made primary, then there is implicit the suggestion that the stimulus word evokes a wide range of responses. This suggests a strengthening of remote associations. One explanation could be that schizophrenics have learned many inappropriate associations; another that they have not had experiences which would strengthen the associations with the highest probability of relevance; and another that schizophrenics are in a high drive state, possibly because of anxiety, and so remote associations are strengthened to the point where they occur often.

Mednick (1958) suggests that acute schizophrenics are anxious organisms in a state of high drive and that overinclusion is due to an abnormal degree of stimulus generalization because of

heightened responsiveness. Thinking is then disrupted by the intrusion of remote and irrelevant thought units pushed above the threshold of awareness. According to Mednick's theory the process has its own built-in stabilizer which leads the patient to chronicity. A flattening of the generalization gradient occurs when the many irrelevant thoughts become newly learned techniques for removing anxiety provoking thoughts from awareness.

Lovibond (1954) suggests that overinclusion is only one aspect of a more general abnormality. He puts forth the theory that most concept formation can be regarded as a form of discrimination learning involving inhibition of extraneous elements through lack of reinforcement. In the schizophrenic individual inhibition is weak, causing an extreme degree of stimulus generalization. Concepts learned after the acquisition of the psychosis are the first to be affected, then finally older, past concepts are affected as the process of inhibition becomes weaker. Lovibond's view are supported by McConaghy (1960) who uses the term "allusive thinking" rather than overinclusion. He suggests that allusive thinking, found in some normals and in an exaggerated form in schizophrenics, is due to inheritance of a weak inhibitory process.

Payne (1957) reformulates the theories of overinclusion such as Cameron's, in a more general way. He postulates that overinclusion could be an extreme degree of stimulus generalization. All purposeful behavior, he believes, depends for its success on the fact that some stimuli are attended to and others are ignored. Normal people are unaware of most irrelevant stimuli. It is as if some "filter mechanism" cuts out or inhibits the stimuli, both internal and external, which are irrelevant to the task in hand to

allow the most efficient processing of incoming information. Over-inclusive thinking might be only one aspect of a general breakdown in this filter mechanism.

Payne observes that many schizophrenics behave as if this filter had lost some of its inhibitory properties and allowed irrelevant information to enter the processing mechanism. Selective perception becomes impossible and as the condition becomes more severe, ideas distantly related to concepts in the past as well as the present no longer seem to be screened out. All thought becomes contaminated, vague, and imprecise because of the irrelevant information entering the filter mechanism. Payne agrees with Mednick that overinclusion is suggestive of a flattened gradient of generalization, since many more response tendencies appear to be evoked by a stimulus in psychotic than in normal subjects.

McReynolds (1960) advances the hypothesis that schizophrenia results primarily from an extremely high level of unassimilated material. If incoming percepts fit harmoniously into conceptual schemata already present, they may be assimilated easily; if they do not so fit, considerable restructuring of the schemata may be required before assimilation may occur. If the number of percepts incongruent with a given schema become great enough, then unassimilated material will tend to accumulate. McReynolds postulates that anxiety is some function of the magnitude of incongruent, unassimilated material.

McReynolds admits that there is no direct evidence that schizophrenia is typically preceded by the condition of a very high level of unassimilated material. However, it is known that schizophrenic reactions often may follow a drastic change in one's

pattern of living, such as is likely to present many new percepts for assimilation. The crucial factor, however, is the extent to which over previous years such incongruencies have been developed as will prevent assimilation of the new percepts. The schizophrenic may be able, by drastic restructuring of conceptual schemata, bring about marked reduction in the level of unassimilated material. The paranoid schizophrenic most characteristically devises special conceptual schemata in order to bring about assimilation. He would tend to use rigid, stringent criteria for assimilation and the percept groupings would tend to be narrow, or underinclusive.

On the other hand, another type of schizophrenic may attempt to bring about assimilation of the unassimilated percepts by using lax standards with broad or overlapping percept groupings. In an effort to reduce anxiety the patient may tend to increase the range of available categories to which given percepts may be assigned. In this way incongruencies could be avoided because of the assimilation of otherwise unassimilable percepts. Thus overinclusion would occur. McReynolds proposes that his theory, while framed in a different context, is in agreement with Cameron's concept of overinclusion and underinclusion.

While most of the above theoretical formulations are drawn from different sources and represent varying view points, there are nevertheless some common elements. There is considerable agreement that schizophrenics have difficulty in differentiating between self and object, and ego and non-ego, making for much confusion in differentiating between essential and non-essential details, relevant and irrelevant percepts and reality and fantasy. There is also agreement concerning the schizophrenic individual

being overwhelmed by a great number of irrelevant, incongruous or unassimilable stimuli which he is unable to filter out, select or assimilate. Most of the view points outlined in this section agree that some schizophrenics are fluid in their concept formation, while others are rigid. The terms "overinclusion" and "underinclusion" were often not stated as such, but it seems reasonable to assume that they could be applied in most of these theoretical formulations.

Summary of the Readings

There has been much investigation of disorder in schizophrenic concept formation, from two viewpoints which see it as either a deficit or a disturbance. The earliest studies were concerned with the deficit approach, attempting to solve the problem of whether the schizophrenic thinks in concrete or abstract terms. No definite conclusions have been found in this area, largely because the terms "concrete" and "abstract" have not been adequately defined or measured, and also because both types of thinking probably occur in schizophrenia.

Evidence of the fact that some schizophrenics think in abstract but bizarre or unusual terms has led to investigations from the second viewpoint, where schizophrenic concept formation is seen as a type of disturbance. The many studies in this area have approached the problem from various levels. Of particular importance to this study are the investigations which show that schizophrenic concept formation is characterized by such difficulties as an abnormal amount of overinclusion, interpenetration of personal themes, extreme degrees of stimulus generalization, failure in inhibition, faulty integration, impairment of system-forming factors or connections,

inability to distinguish between self and object or reality and fantasy, deficiency in maintain a set, an abnormally high level of unassimilated material, and a high drive state with anxiety. All these investigations have contributed to the theory of over-inclusion by generally agreeing that over-responsiveness to inappropriate stimuli plays some part, either major or minor in schizophrenic concept formation.

Ego psychology has also made a similar contribution through the concepts of lowered ego cathexis in schizophrenia, and fluidity of the ego boundaries, attempting to explain how elements from the periphery may break in and overwhelm the person with unrelated stimuli.

Some theorists attempt to trace the schizophrenic process back to childhood, seeing it as a failure in social articulation, or a disturbance in interpersonal relations originating in a basic inconsistency on the part of the parents. Such inconsistency would make for conflict regarding reflected appraisals, inability to distinguish between reality and fantasy, ego and non-ego and self and object. The schizophrenic adult is unable to distinguish between what is relevant and what is not in a given situation. He is not able to adequately interpret stimuli and is thereby overwhelmed by irrelevant ideas and experiences.

It is interesting to note that the various investigations and theoretical viewpoints, while originating from diverse sources, all agree on one common factor which is basic to the theory of over-inclusion -- the schizophrenic is unable to differentiate, filter out, select or assimilate material which is pertinent or relevant to any given situation. This difficulty is probably more apparent

in social situations.

There has been some investigation into the question of whether overinclusion is a basic or secondary schizophrenic disturbance. In addition, some studies have been concerned with the apparent variability in schizophrenic performance, ranging from underinclusion through normal concept formation to abnormal overinclusion. Some studies have pointed out differences between acute and chronic cases, while others have stressed differences between various schizophrenic subtypes. The results of the few investigations carried out in this area have been rather ambiguous. There is evidence, at least, for a extreme degree of variability in schizophrenic concept formation. Some schizophrenics tend toward overinclusion, others toward underinclusion, while others do not appear to differ in any noticeable way from normals in their performance. There would seem to be much need for further investigations regarding the variability of schizophrenic performance.

The survey of the literature has not disclosed any studies of the phenomenon of overinclusion as it might occur during intelligence testing. It was felt by the writer that such a research would be useful. The Picture Completion test would provide the clinician with a measure of overinclusion, easy to administer and score. If overinclusion is as characteristic of schizophrenic disorder as the literature suggests, then some measure of overinclusion should be a part of routine clinical testing procedures. The Picture Completion Test could therefore prove to be a valuable diagnostic tool for the clinician.

The test would also provide an opportunity to investigate quantitative versus qualitative differences among various groups in regard to overinclusion errors. The groups could be compared

on the basis of the degree of "bizarreness" of responses.

The majority of the investigators whose studies are cited in the literature used sorting tasks, proverbs, and in some instances their own tests of overinclusion. The Picture Completion test is of course different in some respects. No principle of sorting is involved and there is no direct measure of concept formation or learning. The test resembles other tasks in that it measures the ability to differentiate between what is relevant and what is not.

There appear to be two methods of explaining overinclusion. While some investigators see it as a type of over-generalization, others define it as the inability to sort out, select or differentiate between what is relevant or essential and what is irrelevant or unessential. The Picture Completion Test probably would measure the latter type of overinclusion.

Although there has been a considerable amount of research on overinclusion, the investigation to be reported in this paper was undertaken with the anticipation that it would contribute to the already existing literature by attempting to provide the clinician with a method for measuring overinclusion on the W.A.I.S., and by investigating qualitative and quantitative differences in overinclusion between normal, neurotic, psychopathic and schizophrenic subtype groups.

Chapter III

PROCEDURE

Description and Administration of the Test

The test used in this study was the Picture Completion test (subtest number eight) of the Wechsler Adult Intelligence Scale. The test consists of 21 pictures. Each subject is given all items. Before presenting the first picture the examiner says, "I am going to show you some pictures in which there is some important part missing. Look at each picture and tell me what is missing". A time limit of 20 seconds is given for each item. The subject is not required to give the exact name of the missing part to receive credit as long as it is clear that he is describing the correct feature. One point is given for each correct response.[1] The actual Picture Completion responses were recorded and later copied on a duplicate sheet for statistical analysis.[2]

The subtest was administered as part of a general assessment of intelligence. In all cases at least eight W.A.I.S. subtests were completed by the subject. These were the Information, Comprehension, Similarities, Digit Span, Digit Symbol, Picture Completion, Block Design, Picture Arrangement and Object Assembly tests. Verbal, performance, and full scale intelligence quotients were obtained.

Classification of Failures as Overinclusive or Underinclusive

Each subject's responses on the Picture Completion test were recorded on a data sheet[3] and the failures were classified as either overinclusive (o) or underinclusive (u). Each error

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1 - Wechsler (1955)
2 - Appendix B (i)
3 - Appendix B (i)

was scored as one point and total o and u scores were tabulated for each subject.

Overinclusion

This category included the following types of failures:

(1) Naming parts of the picture such as objects, persons, events, or situations not intended to be there.

(2) Naming small unnecessary details as missing.

(3) Naming as missing parts of the picture already there.

(4) Card criticism of details already there.

(5) Misidentification of details, objects, or events in the picture.[1]

Underinclusion

The underinclusive category included the following types of failures:

(1) Inability or reluctance to see what is missing.

(2) Inability or reluctance to see anything at all missing.

(3) Card naming or card description.

(4) Page turning without any response.[2]

The method of classifying failures was checked against bias by having another psychologist, after verbal instructions, choose at random thirty data sheets, five from each group, and rate each subject's errors. There was complete agreement, with no difference of opinion as to how the errors should be classified.

Description of the Sample

All persons included in the study had been referred to the writer for intelligence testing (as well as personality testing in some cases). The total sample of 140 persons contained 40 normals,

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1 - Examples of each type of overinclusion failure are listed in Appendix B (ii)

2 - Examples of each type of underinclusion failure listed in Appendix B (iii).

20 pathological personalities, 20 psychoneurotics, 20 catatonic schizophrenics, 20 paranoid schizophrenics, and 20 undefined schizophrenics.

Group I, normal staff members of the Provincial Mental Hospital, had been examined as part of the hospital's regular screening process for prospective staff employees or prospective nursing students. The cases were selected from past records of applicants from August 1, 1956 to approximately August 1, 1958. Only those persons still on staff as of December, 1960 were included, on the assumption that the 2 to 4 year period of employment would be another indicator of relatively stable adjustment.

The remaining groups consisted of 100 patients of the Provincial Mental Hospital, their admission to hospital dating from August 1, 1956. These patients had been diagnosed at the hospital's weekly diagnostic conference. The cases used in the study included only those patients whose diagnoses were agreed upon by at least 3 of the 4 doctors or psychiatrists present at the conference. Diagnoses are made at the hospital according to the procedure outlined in the Mental Statistics Handbook of the Dominion Bureau of Statistics, Health and Welfare Division, under "Section Four, Classification of Mental Disorder".[1]

Description of Diagnostic Categories

Group II consisted of 20 pathological personalities. These are defined as "disorders of character, behavior and intelligence". Six subjects were diagnosed as "Pathological Personality - Inadequate Type". The Handbook describes these personalities as

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1 - Handbook (48), p.46.

"characterized by an inability to meet life's demands - they do not exhibit severe defeat in any field but are generally unable to adapt to specific situations such as marriage, home life or occupation".[1] The diagnosis of "Pathological Personality - Antisocial Type" was given for 7 subjects. These cases are characterized largely by "emotional immaturity or childishness with marked defects of judgment and without evidence of learning by experience. Impulsive reactions are common, as are mood changes and rationalization".[1] The remaining six cases were classified as "Pathological Personality - Sexual Deviation". According to the Handbook this diagnosis is reserved for cases where the sexual deviation "is not symptomatic of some other psychiatric disorder" and includes "exhibitionism, fetishism, homosexuality, pathological sexuality, sadism and sexual deviation".[2]

Group III was made up of 20 psychoneurotics, Of these cases, 10 were diagnosed as "Psychoneurosis - Anxiety State". "These cases show more or less continuous diffuse anxiety and apprehension. Feelings of acute panic and acute tension are extrmely common and emotional tension is high".[2b] The remaining 10 subjects were classified as "Psychoneurosis - Reactive Depression". These people show "depression in reaction to obvious external causes such as bereavement, sickness and other worries. The reaction, of a more marked degree and of longer duration than normal sadness, may be looked upon as pathological. The anxiety in this reaction is replaced to some extent by depression and self-depreciation. Feelings of guilt are common".[3]

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1 - Handbook (48), p.46
2 - Handbook (48), p.47
2b - Handbook (48),p.42
3 - Handbook (48), p.43

Group IV, V, and VI were primarily schizophrenic disorders. In this general group of psychotic reactions there is "disturbance in reality relationships and concept formations with affective, behavioral and intellectual disturbances in varying degrees and mixtures. The disorders are marked by a strong tendency to retreat from reality, by emotional disharmony, unpredictable disturbances in stream of thought, aggressive behavior and, in some, by a tendency to deterioration".[1]

The 20 subjects in Group IV were classified as "Schizophrenia - Catatonic Type". These reactions "are characterized by usually a conspicuous alternating state with either marked generalized inhibition (stupor, mutism, negativism, and waxy flexibility) or excessive motor activity and excitement. The latter shows marked impulsiveness and belligerence. In retrospect it is usually found that the sensorium has remained clear. Regression to a negative state may occur".[1]

The 20 Group V subjects were diagnosed as "Schizophrenia - Paranoid Type". This disorder is "characterized by prominence of delusional ideas, generally of a persecutory or grandiose nature. A consistent emotional reaction of aggressiveness due to persecutory delusions is most frequent. The hallucinations occur in various fields to which the patient frequently responds. Excessive religiosity or expansive delusional system of omnipotence, genius, or special ability are also found here. The systematized paranoid hypochondriacal states are included in this group".[2]

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1 - Handbook (48) p.34
2 - Handbook (48) p.35

Group VI was consisted of 20 cases diagnosed as "Schizophrenia - Type Undefined". These are unspecified schizophrenic reactions which according to the Handbook "cannot be classified in the previous groups of schizophrenias"[1].

Method of Matching the Sample Groups

The six groups were matched on a general group basis according to age, intelligence, educational and occupational background. Ages ranged from 20 - 35; the intelligence quotients ranged from 100 - 115; educational level from Grade 8 to 11; and the occupations ranged from laboring jobs to semi-professional occupations.

Table I

Sex Ratio, Age Range, Mean and Standard Deviation of Total Group and Sub - Groups

	N	M	F	Age Range	Age Mean	S.D
Total Group	140	77	63	20-35	26.86	
Group 1 - Normal	40	20	20	21-35	26.27	4.25
Group 2 - Pathological Personality	20	15	5	20-35	26.45	3.46
Group 3 - Psychoneurotic	20	12	8	22-35	28.60	4.31
Group 4 - Schizophrenia, Catatonic	20	12	8	20-35	26.80	4.69
Group 5 - Schizophrenia, Paranoid	20	10	10	21-33	26.95	3.57
Group 6 - Schizophrenia, Undefined	20	8	12	20-35	26.78	4.52

It will be noted that the age mean is highest for Group 3. The majority of subjects in this group had had previous admissions to General Hospital, being admitted to P.M.H. in their later twenties or early thirties.

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1 - Handbook (48) p.36

Table II

Intelligence Range, Mean, and Standard Deviation of Total Group and Sub - Groups

	N	I.Q. Range	I.Q. Range	S.D.
Total Group	140	100-115	107.53	
Group 1 - Normal	40	101-115	107.72	4.51
Group 2 - Pathological Personality	20	100-115	107.60	4.70
Group 3 - Psychoneurotic	20	100-115	107.40	4.48
Group 4 - Schizophrenia, Catatonic	20	100-115	107.65	4.32
Group 5 - Schizophrenia, Paranoid	20	100-115	107.10	4.91
Group 6 - Schizophrenia, Undefined	20	100-115	107.45	4.48

Table III

Educational Background, Range and Mean of Total Group and Sub - Groups

	N	Educational Range	Educational Mean
Total Group	140	Gr.8-11	9.60
Group 1 - Normal	40	Gr.8-11	9.85
Group 2 - Pathological Personality	20	Gr.8-11	9.85
Group 3 - Psychoneurotic	20	Gr.8-11	9.85
Group 4 - Schizophrenia, Catatonic	20	Gr.8-11	9.95
Group 5 - Schizophrenia, Paranoid	20	Gr.8-11	9.85
Group 6 - Schizophrenia, Undefined	20	Gr.8-11	9.85

The occupational backgrounds ranged from laboring to semi-professional occupations. The distribution of occupations in each group is listed in Appendix A(i). No attempt was made to rigorously match the groups according to occupational backgrounds.

Cases were selected by taking from the psychometric files only those records satisfying the criteria for matching according to intelligence, age and background. The information was gained from the W.A.I.S. record form and copied, together with Picture Completion responses, on the data sheets. At this time the

writer did not know, in the majority of cases, what diagnosis had been assigned to each patient. (Psychometric examination usually takes place fairly early in the patient's hospitalization, before he or she is presented at diagnostic conference) Information concerning the patient's diagnosis was then obtained from the medical records or files. The diagnosis was the last item of information to be entered on the data sheet. It was felt that bias would be reduced by the use of this procedure. The writer did not select any subjects who had been examined after December, 1959, thereby avoiding further bias through using cases seen after the present research had been formulated.

Chapter IV

RESULTS

A presentation of the results will be given in this chapter.

Section I will deal with a preliminary investigation of the data, the types of failures, and the actual items failed by each group.

Section II will be concerned with the three major hypotheses and will present the statistical analysis of the findings in connection with each hypothesis.

Section III will deal with the investigation of sex differences and their effect on the results.

Section I - Preliminary Investigation of the Data

In the preliminary investigation of the data the total overinclusion and underinclusion errors were calculated, together with means and standard deviations for each group. Both types of errors were calculated in percentages. Figure I presents a histogram of mean overinclusion and median underinclusion errors. Preliminary investigation revealed much variability in the number of errors made, both within and between groups.

Inspection of Item Failures

Histograms representing the distribution of item failures in each group were plotted in order to enable a closer inspection of actual items failed.[1] A question had arisen concerning whether any particular items were consistently failed by any one group, or whether any particular items brought forth abnormal or pathological

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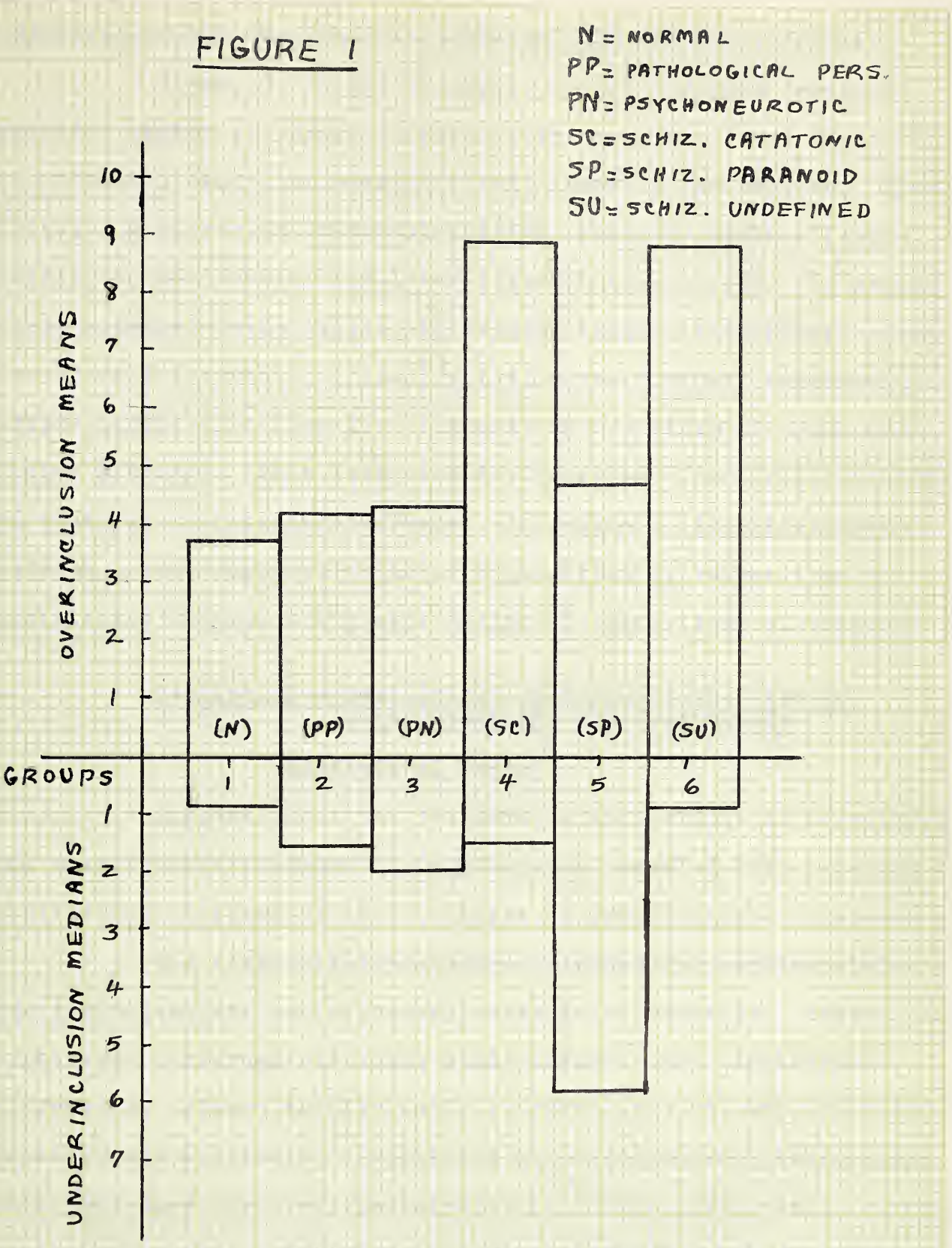
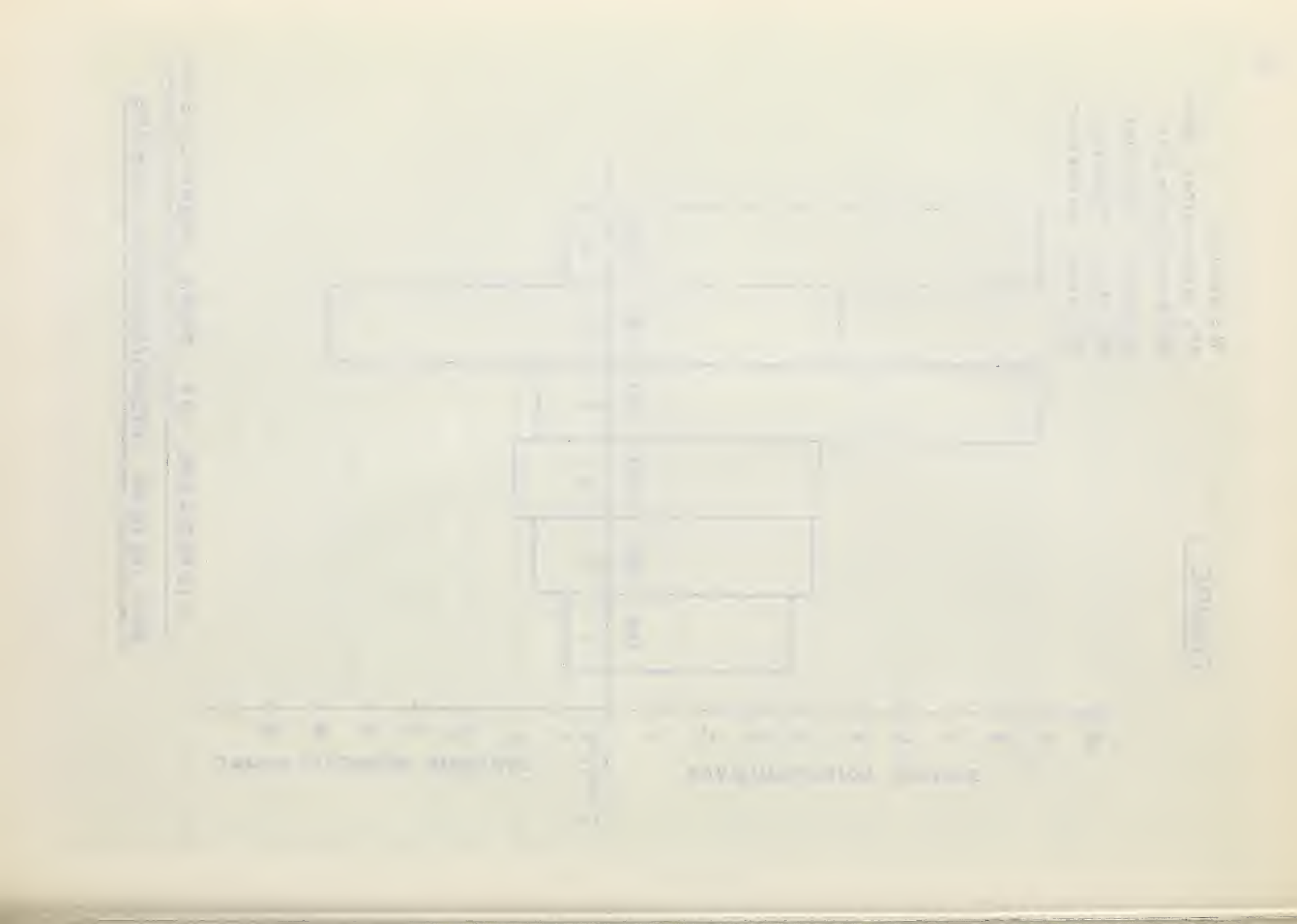
1 - Histograms of item failures for each group are presented in Appendix C, Figures 2 - 7.

FIGURE 1



HISTOGRAM OF MEAN OVERINCLUSION AND MEDIAN UNDERINCLUSION ERRORS



responses in any one group as compared with the other groups.

Items 13, 20 and 21 appear to have brought forth the greatest number of errors in most of the groups. Items 20 and 21 are probably among the most difficult items in the subtest. Item 13 (U.S. Map) may be culturally biased, possibly making it more difficult than some of the later items in the subtest. In general there appeared to be little differences between the groups, except for Group V (paranoid schizophrenics) where frequent underinclusion errors occurred on Item 17. (Item 17 is a picture of a man with a finger missing). This item possibly presents a particular difficulty of some kind for paranoid groups. In general, any differences between groups appeared to be of a quantitative rather than a qualitative nature, all groups making the same types of errors.

Section II - Statistical Analysis of the Data in Connection with the Predictions

Statistical Method

Inspection of the frequency distributions of overinclusive and underinclusive errors for each groups revealed that separate statistical analyses of the two types of errors should be applied.

The statistical procedure selected for working with the overinclusive data was a one-way analysis of variance. Because the hypotheses concerned with this study assumed that significant differences between samples would be found, the one-way analysis of variance was applied to investigate the differences between means. This procedure involved the calculation of the total sum of squares, partitioning this total into a within-group and a between-group sum of squares and dividing these by the associated degrees of freedom to obtain the within- and between-groups variance estimates. An

F ratio was calculated, the null hypothesis was rejected and a "t" test was applied for the purpose of comparing means two at a time.[1] A two-tailed test of significance was used. Although the hypothesis had assumed that the means of the schizophrenic groups would be greater than those of the other groups, there was some uncertainty about the direction of differences between the schizophrenic groups themselves.

Inspection of the frequency distribution for underinclusive errors showed that the samples were extremely skewed. For that reason, non-parametric methods were used. The Kruskal-Wallis one-way analysis of variance by ranks was chosen as being appropriate for comparing the significance of the differences between means. The Kruskal-Wallis test is a rank test requiring at least ordinal measurement of the variable. According to Siegel (1956) it is the most efficient of the non-parametric tests, having a power-efficiency of 95.5 percent when compared with the F test, the most powerful parametric method.

The procedure involved ranking all the groups in a single series, determining the sum of ranks for each group, correcting for ties, and computing H. The observed value of H was assessed from a chi square table.[2]

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1 - Formulas and general statistical procedure are outlined in Appendix D (i). They are taken from Ferguson (1959) p.227-241.

2 - The formulas and general statistical procedure are outlined in Appendix D (ii). They are taken from Siegel (1956) p.184-194, and Ferguson (1959) p.270-272

Section III - Statistical Analysis of the Data in Connection with the Predictions

Hypothesis I

The first hypothesis, that failures on the Picture Completion test are more frequent in schizophrenic groups than in normal, neurotic or psychopathic groups -- was verified as predicted, Table IV shows the total errors, ranges, and means for each group.

Table IV

Total Item Failures, with Ranges and Means

	N	Total Errors	Range	Mean
Group I - Normal	40	212	0- 9	5.30
Group II - Pathological Personality	20	123	0-11	6.15
Group III - Psychoneurotic	20	137	0- 8	6.85
Group IV - Schizophrenia, Catatonic	20	216	0-14	10.80
Group V - Schizophrenia, Paranoid	20	202	0-13	10.10
Group VI - Schizophrenia, Undefined	20	207	0-16	10.35

Each of the schizophrenic groups has a higher mean, almost doubled in size, than any of the other three groups. An analysis of variance was not attempted because of the abnormal distribution of the underinclusive data.

Hypothesis II

The second hypothesis was that schizophrenic groups tend to overinclude more than do normal, neurotic or psychopathic groups. Tables V and VI present the results of the analysis of variance, where the hypothesis is partially verified.

Table V

One-Way Analysis of Variance: Between and Within Group Variance Estimates of Overinclusion Errors

Source of Variance	Sum of Squares	Degrees of Freedom	Variance Estimate	F Ratio
Between	654.72	5	130.94	14.05
Within	1248.27	134	9.32	

The F ratio of 14.05 was found to be significant at the .01 level of significance. The null hypotheses was then rejected, and the groups were compared two at a time. Table VI presents the results of the "t" test.

Table VI

Table of "T" Test of Differences Between Means for Overinclusion Errors

	II	III	IV	V	VI
Group I - Normal	47	.62	5.17*	.97	5.12*
Group II - Pathological Personality	--	.15	4.70*	.50	4.65*
Group III - Psychoneurotic	--	--	4.55*	.35	4.50*
Group IV - Schizophrenia, Catatonic	--	--	---	4.20*	.05
Group V - Schizophrenia, Paranoid	--	--	---	---	4.15*

* $p < .001$, two tailed "t" test

The hypothesis was verified as predicted for the catatonic and undefined schizophrenic groups. Each of these two groups overincluded significantly more than the normal, psychopathic or psychoneurotic groups. All mean differences reached the .001 level of significance. However, the hypothesis was not verified with respect to the paranoid schizophrenic group. The catatonic and undefined schizophrenic groups overincluded significantly more than the paranoid group, at the .001 level of significance.

Hypothesis III

The third hypothesis was that schizophrenic groups tend to underinclude less than do normal, psychopathic or psychoneurotic groups. The value of H obtained from a one-way analysis of variance by ranks was found to be significant at the .001 level of significance, but the differences were not in the anticipated direction. Table VII presents the results of the analysis of variance where the hypothesis is not verified.

Table VII

One-Way Analysis of Variance by Ranks: Table of Significant Mean Difference for Underinclusion Errors

	II	III	IV	V	VI
Group I - Normal	37	.92	.32	3.82*	.08
Group II - Pathological Personality	--	.55	.05	3.45*	.45
Group III - Psychoneurotic	--	--	.60	2.90*	1.00
Group IV - Schizophrenia, Catatonic	--	--	--	3.50*	.40
Group V - Schizophrenia, Paranoid	--	--	--	---	3.90**

** $p \leq .001$, chi square values
* $p \leq .01$, chi square values
* $p \leq .02$, chi square values

There were no significant differences in underinclusion errors among the catatonic schizophrenics, undefined schizophrenics, normal, psychopathic or psychoneurotic groups. Contrary to prediction, the paranoid schizophrenic group underincluded more than the normal, psychopathic and catatonic schizophrenic groups at the .01 level of significance, more than the undefined schizophrenic group at the .001 level of significance and more than the psychoneurotic group at the .02 level.

Section III - Investigation of the Effect of Sex Differences on Overinclusion and Underinclusion

During the course of the investigation the question of sex differences and their effect on test performance had arisen. Preliminary investigation of the male and female groups showed a general trend in the female group toward slightly higher means for both overinclusion and underinclusion errors, suggesting more variability in the female group, in both directions. However, an F ratio of .469 obtained from a one-way analysis of variance of overinclusion errors was not significant, nor was an H value of .679, the result of a one-way analysis of variance by ranks of underinclusion errors.

Chapter V

DISCUSSION

The chapter will present a discussion of the findings as they relate to the hypotheses, the literature and future research.

Normals, psychopaths and psychoneurotics appear to have served well as "control" groups. No significant differences between these groups were noted. At the same time they were found to differ markedly from the three schizophrenic groups.

While the normals and psychoneurotics performed as anticipated, the psychopathic group's performance could not be predicted from a survey of the literature. The present study appears to be the first investigation of overinclusion in behavior disorder personalities. For that reason such a group was included in an attempt to lend further support to the literature findings that a marked degree of overinclusion is probably related to psychoticism rather than other abnormal mental conditions.

Payne and Hirst's (1957) findings, although not verified by Payne and Hewlett (to be published), lead to the question of whether or not depressives overinclude to the same degree as do schizophrenics. The writer was unable to investigate this area due to the lack of availability of neurotic and psychotic depressive subjects. Ten depressives were included in the neurotic group and were not found to overinclude to any great extent. However, if overinclusion is in fact related to psychoticism, then it would seem reasonable to hypothesize that it might be marked in a psychotic depressive illness. Future research using neurotic and psychotic depressives, as well as manic-depressives, might prove useful.

The validity of the W.A.I.S. Picture Completion test as a measure of overinclusion and underinclusion could have been checked more closely by administering a test such as the Epstein Overinclusion Test to the subjects concerned in the study, and comparing the results to ascertain the degree of correlation between the measures. Unfortunately this procedure was not possible because much of the test data chosen was that of patients already discharged from the hospital.

The Picture Completion test was chosen as the most likely subtest where overinclusion would occur in such a way that it could be measured quantitatively. While overinclusion in all probability occurs on other W.A.I.S. subtests such as the Information, Comprehension, Similarities and Vocabulary tests where irrelevant words, associations and many unessential stimuli could be overincluded, it would probably be more difficult to measure because of the qualitative aspects of these subtests.

The assumption that the Picture Completion test in fact measures overinclusion has already been discussed. Studies by Hanfmann (1939), Balken (1943) and Shneidman (1948) verify the hypothesis that overinclusion can be measured by pictures, particularly those which are incomplete or fairly unstructured. The Picture Completion test presents both incomplete and partly unstructured pictures, affording much opportunity for overinclusion to occur. It also, in the writer's opinion, contains many "distractors". Two studies (16,17)[1] have already been mentioned where a high degree of overinclusion was produced by distractor items.

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1 - Chapman (1956), Chapman and Taylor (1957).

All failures were classified as being either overinclusive or underinclusive. It is interesting to speculate whether any kinds of mistakes could occur which would be of a different type. None were noted in the data collected, and the writer could not think of any such errors. It appears that all errors on the Picture Completion Test can take one of two directions, either overinclusive or underinclusive, supporting the assumption that the test does in fact measure overinclusion.

It is necessary at this point to compare the test with various other measures of overinclusion cited in the literature. The fact that the Picture Completion test does not appear to directly measure skill in concept formation as required by the sorting tasks has already been discussed. No principle of sorting is involved and there is no grouping of objects into the categories or concepts to which they belong. In the sorting tasks all the stimuli are presented to the subject, whereas in the Picture Completion test the subject must himself provide the relevant stimuli. There is of course the possibility that the two different types of tasks in fact measure two different kinds of overinclusion. Another consideration is that one task as a measure of overinclusion may be superior to the other. Some of the difficulty in comparing the two kinds of tasks could perhaps have been overcome by administering sorting tasks to all subjects used in the study and evaluating their results on both tasks for degree of correlation of overinclusion scores.

The Picture Completion test bears more resemblance to the other measures of overinclusion mentioned in the literature, such as the incomplete sentences and picture completion tests. In these

tasks the subject is not called upon to sort to any extent. He is required to provide relevant stimuli or meanings in order to finish the incomplete and relatively unstructured tasks. Studies using these tests as measures of overinclusion appear to be more pertinent for the study at hand, but there has been little research in this area. The literature has provided very few studies of overinclusion which could be cited as being directly related to the present research.

According to the literature there are a number of tests which are claimed to measure overinclusion. Actually it seems likely that the phenomenon of overinclusion can occur in various problem-solving situations. If this speculation is true, then perhaps the fact that the tasks are in some cases quite different may not be of any great importance, particularly in studies such as the present one, where the emphasis is mainly on measurement of the amount or degree of overinclusion rather than the various types or forms it can take, or its causes. One could then assume that any of the studies of overinclusion outlined in the literature would make a worthwhile contribution to the interpretation of the present findings.

The catatonic and undefined schizophrenics performed as predicted, overincluding significantly more than did the normal, psychopathic or neurotic groups. The findings here are in keeping with most of the studies (3,12,15,16,21,41,49,52,53)[1] already done in this area, again showing that schizophrenics overinclude more than do other maladjusted persons or normals. However, the findings also indicate that schizophrenics do not consistently overinclude. Their variability in performance should not be overlooked. Some

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1 - Balken (1943), Cameron (1939,1951), Chapman (1956), Epstein (1953), Lovibond (1954), Moran (1953), Payne and Hirst (1957), Payne, Mattussek and George (1959).

schizophrenics made very few overinclusion errors, and several performed more efficiently than did some of the individuals in other groups. There appears to be much variability in schizophrenic performance, ranging from underinclusion to overinclusion, and verified by other studies (13,15,16,17,21,23,51,52,53,76)[1]. Prediction of an individual schizophrenic subject's performance would therefore be very difficult. In view of the fact that the differences between schizophrenic and other groups are not consistent in either direction, the Picture Completion test would probably not serve as a good diagnostic tool except in cases of extreme deviation in either direction. There had been some speculation that the test might be of value in differential diagnosis.

The paranoid schizophrenic group did not perform as predicted. The highly significant amount of underinclusion found in this group is rather difficult to account for. The majority of studies already carried out have been concerned mainly with overinclusion. There appears to have been very little actual investigation of underinclusion, except for studies (21,56)[2] where no abnormal underinclusion was found in schizophrenic groups, and other investigation (46,72,76)[3] showing that some schizophrenics do underinclude. Most investigators have classed all subtypes of schizophrenia in one group without looking for differences between paranoids and non-paranoids. In two studies (19,62)[4] where the majority of subjects were paranoids, a highly significant degree of overinclusion rather than underinclusion was found. The findings to date are rather ambiguous. Perhaps further investigation of the different subtypes would be rewarding.

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1 - Cameron (1946), Cameron and Magaret (1951), Chapman (1956), Chapman and Taylor (1957), Epstein (1953), Feinberg and Garman (1961), Payne et al (1957), (1959) (1961), Zaslow (1950)

2 - Epstein (1953), Rapport, Gill and Schafer (1945)

3 - McReynolds)1960), White (1949), Zaslow (1950)

4 - Daston, King and Armitage (1953), Shneidman (1948).

Several explanations might help to account for the findings of abnormal amounts of underinclusion in paranoid schizophrenics. It may be that some of the responses which were scored as underinclusive were actually indicative of nothing more than negativism or a reluctance to cooperate with test proceedings; however this does not seem to adequately account for the findings, since all subjects were cooperative.

Another explanation could be that the criteria for diagnosing the different subtypes of schizophrenia may vary from hospital to hospital. This problem was discussed with the Clinical Director and another psychiatrist at the Provincial Mental Hospital. They felt that the diagnosis of paranoid schizophrenia is a rather stringent one at the Ponoka hospital, based on evidence of clear-cut or well-defined paranoid delusional systems existing in a fairly well-preserved, although schizophrenic intellect. The opinion was expressed that other hospitals might be less strict, classifying patients as paranoid schizophrenics on the basis of more vague ideas of reference or paranoid delusions. Such patients would in their opinion, perhaps be diagnosed as catatonic schizophrenics or undefined schizophrenics at the Provincial Mental Hospital. Further discussion of this point would not be worthwhile since it is more or less speculative; however, it does seem possible that differences in diagnosis have to some extent affected the findings in this study as compared with others.

Several investigations (17,23,45)[1] have noted some differences between mildly disturbed and severely disturbed schizophrenics and between acute and chronic schizophrenics. Such studies have

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1 - Chapman and Taylor (1957), Feinberg and Garman (1961), McGhie and Chapman (1961).

found that acutely ill schizophrenics tend to overinclude more than do chronically ill patients. This study did not separate the groups in this manner, but the speculation could be made that perhaps the paranoid schizophrenic group contained more chronic cases than did the catatonic or undefined schizophrenic group, hence the differences in degree of overinclusion.

The most plausible explanation for the findings appears to be that a real difference exists between paranoid and other schizophrenic subtypes.[1] Some studies (58) have shown that paranoid schizophrenics are more rigid or constricted in their perceptual judgments, at the same time showing an increased awareness of and sensitivity to events in the external environment. Thus their underinclusiveness would be according to the interpretation of some findings (15,21,74,77)[2] a defense against a tendency to overinclude. One investigator (27)[3] points out that paranoid schizophrenics vary in rigidity, some showing ego rigidity in terms of minimal involvement with the environment, others demonstrating peripheral rigidity and an vulnerability to disturbing stimuli. The paranoid schizophrenics of this study showed extreme variability of this kind, ranging from a score of 11 overinclusion errors to 13 underinclusion errors. It seems likely that some difference in overinclusion does exist between paranoid and non-paranoid groups.

How and why schizophrenics overinclude and why there is variability ranging from underinclusion to overinclusion is not yet fully understood. Theorists such as Lovibond (1954) and Payne (1961) speak of overinclusion as an extreme degree of stimulus generalization due to weak inhibition or failure in a "filter mechanism". Cameron (1958) appears to deal more with the response

1 - Raush (1952)
2 - Cameron and Magaret (1951), Epstein (1953), Winder (1960), Zucker (1958)
3 - Fisher (1950).

end of the process, stating that overinclusion occurs when the individual cannot quickly eliminate from the repertory of responses associated with a certain stimulus those that are inappropriate for the given situation. This implies then according to Winder (1960) and Mednick (1958) that a stimulus evokes a wide range of responses. Remote associations are strengthened and there is a flattening of the generalization gradient. Payne (1961) suggests that future research should formally investigate the relationship between specific tests of overinclusion and a generalization gradient.

Overinclusion on the Picture Completion test involves the inability to sort out or exclude irrelevant stimuli. This operational definition appears to be in keeping with the views of Lovibond and Payne regarding a failure in the filter mechanism. In attempting to better explain the dynamics of the phenomenon, Cameron's and Winder's formulations seem to be more useful. The subject may pick out irrelevant details and continue to respond to them as if they were relevant. This perhaps implies a strengthening of remote associations and a flattened generalization gradient.

One could also speculate that motivation on the part of the subject is implied by the phrase "pick out and respond to" irrelevant stimuli. Cameron's (1951) view that overinclusion and underinclusion occurs in relation to the patient's own need has already been mentioned, as well as Payne's (1961) comment that learning difficulty shown by schizophrenic patients is probably secondary to more fundamental abnormalities of attention, cooperation or motivation. Hunt and Cofer (1944) and Jones (1961) support this view. Perhaps the variability in schizophrenic performance

on overinclusion tests may be partly explained as motivational difficulty.

If remote associations are in fact strengthened, these associations should be related, although distantly, to the stimuli that aroused them. This speculation may appear to disagree with the definition of overinclusion as involving "irrelevant" stimuli. Actually the subject does not perceive the stimuli to which he responds as irrelevant. If he did he would not continue to respond to them. Hanfmann (1939) has commented in his study that a "definite connection" between the inserted object and the represented scene of the Healy Picture Completion test seemed to exist in the mind of the patient, yet he was unable to make this connection clear to the examiner.who saw the responses as irrelevant. Thus the judgment of the response as "irrelevant" is made by the examiner. It was interesting to note that the overinclusion responses given by the subjects, both normal and psychotic, were related, in varying degrees of relevancy, to the pictures. There were no responses so bizarre as to be totally unrelated to the original stimuli of the picture. The quantitative rather than qualitative differences between the responses of the normals and psychotics have already been stressed.

The assumption that overinclusion and underinclusion occur in relation to the patient's need leads to the further question of the immediate contemporary needs involved. According to McReynold's theory (1960), outlined in the survey of the literature, the schizophrenic subject overincludes by actively attempting to take in and assimilate all material or stimuli, both relevant and irrelevant; thus reducing anxiety. At other times he may underinclude by actively restructuring his frame of reference into

a more constricted one and seeking out and assimilating only those aspects of situations which have relevancy for the restricted schemata. In the writer's opinion, a second type of underinclusion could occur where the subject might actively attempt to avoid stimulation by trying to ignore or shut out all stimuli except those necessary for a minimal level of existence. McReynold's theory appears to be in fundamental agreement with Cameron's concept of overinclusion. Both imply the presence of a motivational need on the part of the patient to assimilate an extremely high level of unassimilated, incongruent material. These theories are of course speculative and cannot be applied in any direct way to the W.A.I.S. Picture Completion research, but they may offer some suggestions for the formulation of hypotheses in future research projects having to do with overinclusion.

Although the research reported here can be concerned only with contemporary dynamics, it is perhaps worthwhile, in the interests of future research, to again draw attention to such theorists as Cameron (1946), Sullivan (1946) and Arieti (1959) who stress that the schizophrenic subject has experienced an inconsistent, highly emotional environment characterized by a deprivation of opportunities for making relevant discriminations. Reflective cognition is impaired, and he is unable to interpret incoming stimuli in a realistic manner. The ego psychologists, in particular Federn (1949) and Zucker (1952), stress the fluidity of ego boundaries and impairment of the selection processes in schizophrenia. They comment on the schizophrenic's particular difficulty in handling situations having to do with role taking,

reflective self-appraisal and other social articulation. Future researchers might find an investigation of overinclusion on problems concerning social situations or social concepts to be useful.

It would seem advisable that any further research in schizophrenic overinclusion and underinclusion should investigate differences in the amount of overinclusion among various subtypes of schizophrenia and/or differences among the various phases from pre-schizophrenic through acute to chronic states. The motivational aspects of schizophrenic overinclusion should also be studied. Perhaps the most important finding of the present study is the variability in schizophrenic performance. There is much need for further investigation of this variability, particularly in terms of motivation.

Chapter VI

Summary and Conclusions

This investigation was concerned with a study of over-inclusion and underinclusion as measured by the Picture Completion Test of the Wechsler Adult Intelligence Scale. Three hypotheses were stated: firstly, that schizophrenic groups would make more failures than normal, neurotic or psychopathic groups; secondly, that schizophrenic groups would tend to overinclude more and thirdly, underinclude less, than normal, neurotic or psychopathic groups on the Picture Completion Test.

The total sample of 140 persons was made up of six groups. Group I consisted of 40 normal staff members of the Provincial Mental Hospital. The remaining groups were made up of patients at the Provincial Mental Hospital, each group containing 20 subjects. Group II consisted of pathological personalities of inadequate, antisocial and sexually deviant types. Group III was made up of psychoneurotics with either an anxiety state or reactive depression. Group IV was classified as being schizophrenic patients of the catatonic type. Group V consisted of schizophrenic subjects of the paranoid type. Group VI was made up of undefined schizophrenic subjects.

The total sample contained 77 males and 63 females. The groups were matched on a general group basis for age, intelligence and background. The ages ranged from 20 - 35 years, with means of 26.27, 26.45, 28.60, 26.80, 26.95, and 26.78 for groups I - VI respectively. The intelligence quotients, obtained from the W.A.I.S., ranged from 100 (Average) - 115 (High Average), with means of 107.72, 107.60, 107.40, 107.65, 107.10 and 107.45 for

groups I - VI respectively. The educational backgrounds ranged from Grade VIII - XI, with mean grades of 9.85, 9.85, 9.85, 9.95, 9.85, and 9.85 respectively. Occupational backgrounds ranged from laboring to semi-professional occupations.

The procedure first of all consisted of transferring the Picture Completion responses from the original W.A.I.S. sheet to a data sheet for analysis. A scoring procedure was set up whereby each incorrect response was scored as either overinclusive or underinclusive. Overinclusive and underinclusive scores were tabulated for each group.

Analysis of the data necessitated the use of both parametric and non-parametric statistical procedures. The two methods used were a one-way analysis of variance by means of the F ratio and "t" test for the overinclusive data, and the Kruskal-Wallis analysis of variance by ranks for the underinclusive data.

The hypotheses were partially confirmed. Schizophrenic groups made more errors than the other groups. Inspection of the failures showed that there was variation in the number rather than type of errors made. All groups both overincluded and underincluded. Sex differences appeared to have no effect on performance. The catatonic and undefined schizophrenics overincluded significantly more than the normal, neurotic or psychopathic groups, at the .001 level of significance, but also more than the paranoid schizophrenic group, at the same level of significance. The hypothesis that schizophrenics are abnormally overinclusive was verified only in the case of the two subtypes. None of the schizophrenics underincluded significantly less than the normal, neurotic or psychopathic groups. The paranoid schizophrenic group was found to underinclude significantly more than any of the other groups, at the .02, .01 and .001 levels of significance.

One of the important findings of the study is that a high degree of both overinclusion and underinclusion appears to exist in schizophrenia. While the general findings would indicate that catatonic and undefined schizophrenics tend to overinclude and paranoid schizophrenics tend to underinclude on the W.A.I.S. Picture Completion test, the test itself probably would not be as valuable a diagnostic tool as the writer had anticipated because of the great range of variability in number and type of errors within each group. Some schizophrenics performed as accurately as did normals, while some normals tended toward an abnormal amount of overinclusion and underinclusion.

Overinclusion and underinclusion are apparently found in all individuals, from normal to psychotic subjects, only becoming an aspect of disturbance when exaggerated in schizophrenia. Since overinclusion does not appear to be peculiar to schizophrenia, it seems reasonable to assume that the phenomenon is secondary rather than basic, and that overinclusion and underinclusion represent only one aspect of a more basic personality disturbance found in schizophrenia.

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Appendix A (i)

Occupational backgrounds, ranging from laboring to semi-professional occupations, were distributed in the groups as follows:

Group I - Normal: 5 domestics, 5 ward aides, 9 attendants, 10 nursing aides, 7 first-year nursing students, and 4 second-year nursing students.

Group II - Pathological Personality: 3 laborers, 1 farmer, 1 housewife, 1 truck driver, 2 construction workers, 1 R.C.A.F. corporal, 1 warehouse foreman, 1 C.P.R. steam engineer, 2 nursing aides, 1 beautician, 2 salesmen, 1 advertiser, 3 clerks.

Group III - Psychoneurotic: 2 laborers, 3 housewives, 1 housekeeper, 1 truck driver, 1 construction foreman, 1 power lineman, 2 carpenters, 1 interior decorator, 1 electrician, 1 nursing aide, 3 salesmen, 1 bookkeeper, 1 clerk, and 1 technical student.

Group IV - Schizophrenia, Catatonic: 1 coal miner, 1 construction worker, 1 oilfield swamper, 2 farmers, 1 welder's helper, 5 housewives, 1 machine operator, 1 store clerk, 1 telephone operator, 1 T.V. camera man, 1 C.P.R. locomotive engineer, 1 salesman, 1 nursing aide and 2 clerks.

Group V - Schizophrenia, Paranoid: 1 laborer, 3 farmers, 1 miner, 1 pinsetter, 2 domestics, 2 waitresses, 1 commissionnaire, 3 housewives, 1 tinsmith, 1 practical nurse, 1 clerk, 2 music teachers, and 1 C.P.R. steam engineer.

Group VI - Schizophrenia, Undefined: 1 laborer, 6 housewives, 1 army private, 1 domestic, 1 oil driller, 1 partsman, 1 carpenter, 1 electrician's helper, 1 telephone operator, 1 clerk, 1 hairdresser, 2 nursing aides, 1 radio copy writer, and 1 technical college student.

Appendix B (i)

Subject: _____ Age: _____ Sex: _____ I.Q: _____

Occupation: _____ Education: _____

Diagnosis: _____

Responses - Picture Completion Test, W.A.I.S.

1. Knob _____
2. Tail _____
3. Nose _____
4. Handles _____
5. Diamond _____
6. Water _____
7. Nose piece _____
8. Peg _____
9. Oarlock _____
10. Base thread _____
11. Stars _____
12. Dog tracks _____
13. Florida _____
14. Stacks _____
15. Leg _____
16. Arm Image _____
17. Finger _____
18. Shadow _____
19. Stirrup _____
20. Snow _____
21. Eyebrow _____

Findings:

Appendix B (ii)

Classification of Overinclusion Errors

This category included the following types of failures:

(1) Naming parts of the picture such as objects, persons, events or situations not intended to be there. The following are examples of such responses:

Item 3: Ear

4: Other wheels; driver

5: Picture; suits; rest of deck

6: Hand; half the water

7: Arms; half of his nose

8: Bow; another string

9: Man for canoe

10: Socket; no connection

11: Flagpole; colours; one stripe

12: Boot; left foot; rubbers; gun

13: States; Mississippi basin; Canada

14: Oars; cable; cloud; sail; passengers

15: Tail; marking on back

16: Rest of dresser; rest of table and chair

17: Ground; cap

18: Hand; footprints; houses

19: Rider; saddle horn; bridle

20: Rest of fence; ventilator; loft

21: Shoulders; ear; necklace

(2) Naming small, unnecessary details as missing. (This type of failure is somewhat similar to the above responses.) Examples are:

Item 4: Windshield wipers
7: Lines on side of nose
8: Chin piece
11: Rope
12: Leash; his eye
14: Windows; boat's name
15: Eyes
16: Powder; right arm gone
17: Line on pants; crease; buttons; belt loop
18: Road
20: Shadows; lightning rod; manure pile
21: Shadows; lines; marks around nose and ear

(3) Naming as missing parts of the picture already there. For example:

Item 9: Bottom of boat
10: Filament
13: California, Mexico
15: Head; shell
16: Chair
17: Shirt; pockets
19: Halter; mouth
20: Windows; doors
21: Hair; lips

(4) Card criticism of details already there. Some examples are:

Item 5: Diamonds in wrong place

9: Oars not placed right

11: Stripes are not solid

14: Pennants blowing wrong way

16: Leg on dresser is crooked

17: One arm is bigger

18: The sun isn't that big

19: Mouth not drawn in right

20: Snow too deep; fence is broken

(5) Misidentification of details, objects, events in the picture. This included such responses as:

Item 12: He's walking barefoot through mud

14: The body part of the snail

15: There is a tree in the desert

18: There's not supposed to be a sail there

20: No chimney on the house

Appendix B (iii)

Classification of Underinclusion Errors

This category included the following types of failures:

(1) Inability or reluctance to see what is missing, expressed in such responses as:

  (a) I don't know what is missing

  (b) Can't see anything missing

  (c) Picture is incomplete (no further explanation)

(2) Inability or reluctance to see anything at all missing.

  (a) Nothing missing; absolutely nothing wrong

  (b) Looks all right to me; it's okay

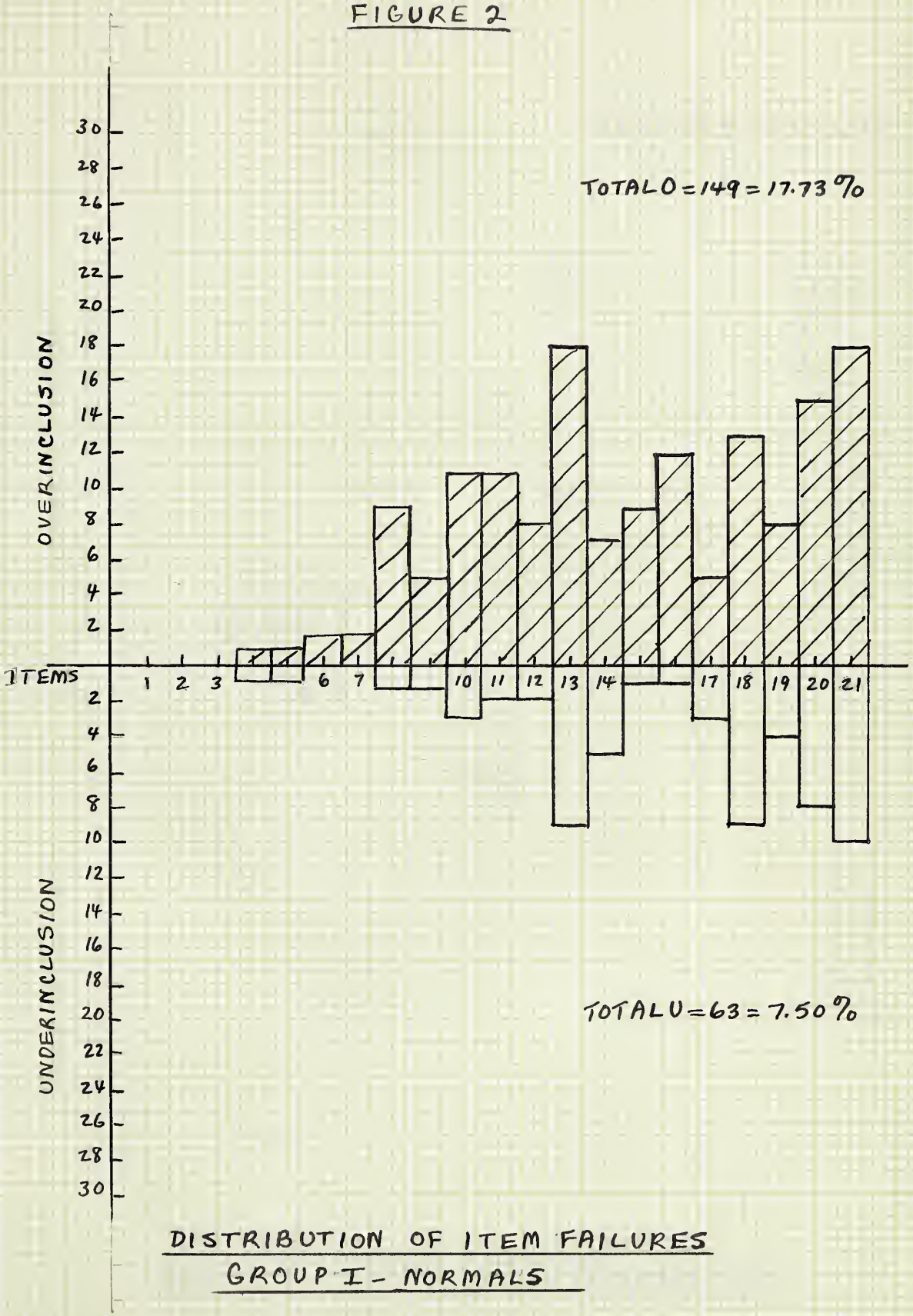
(3) Card naming, or card description, such as:

  Item 10: Light bulb

  13: U.S. map

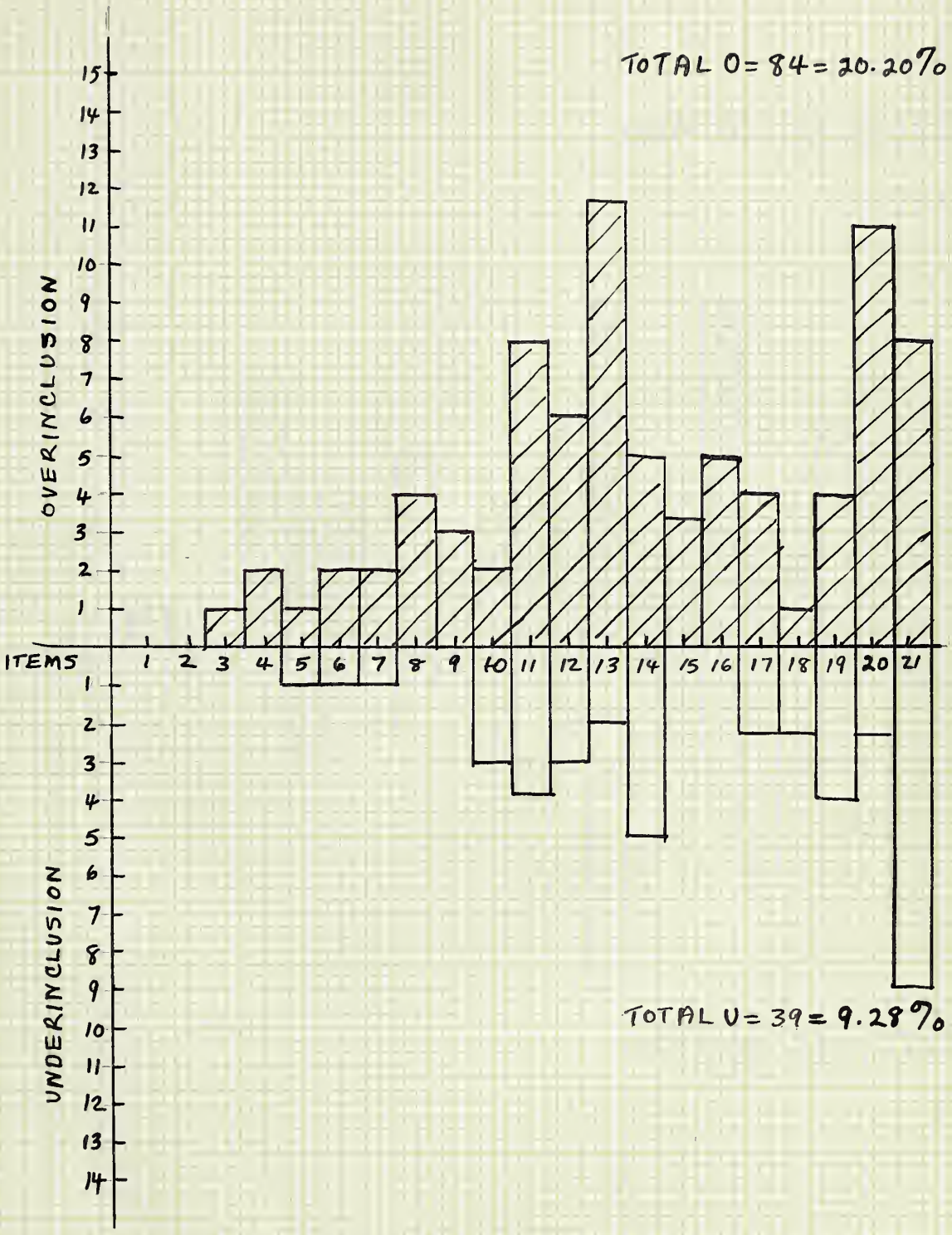
(4) Page turning without any response.

FIGURE 2



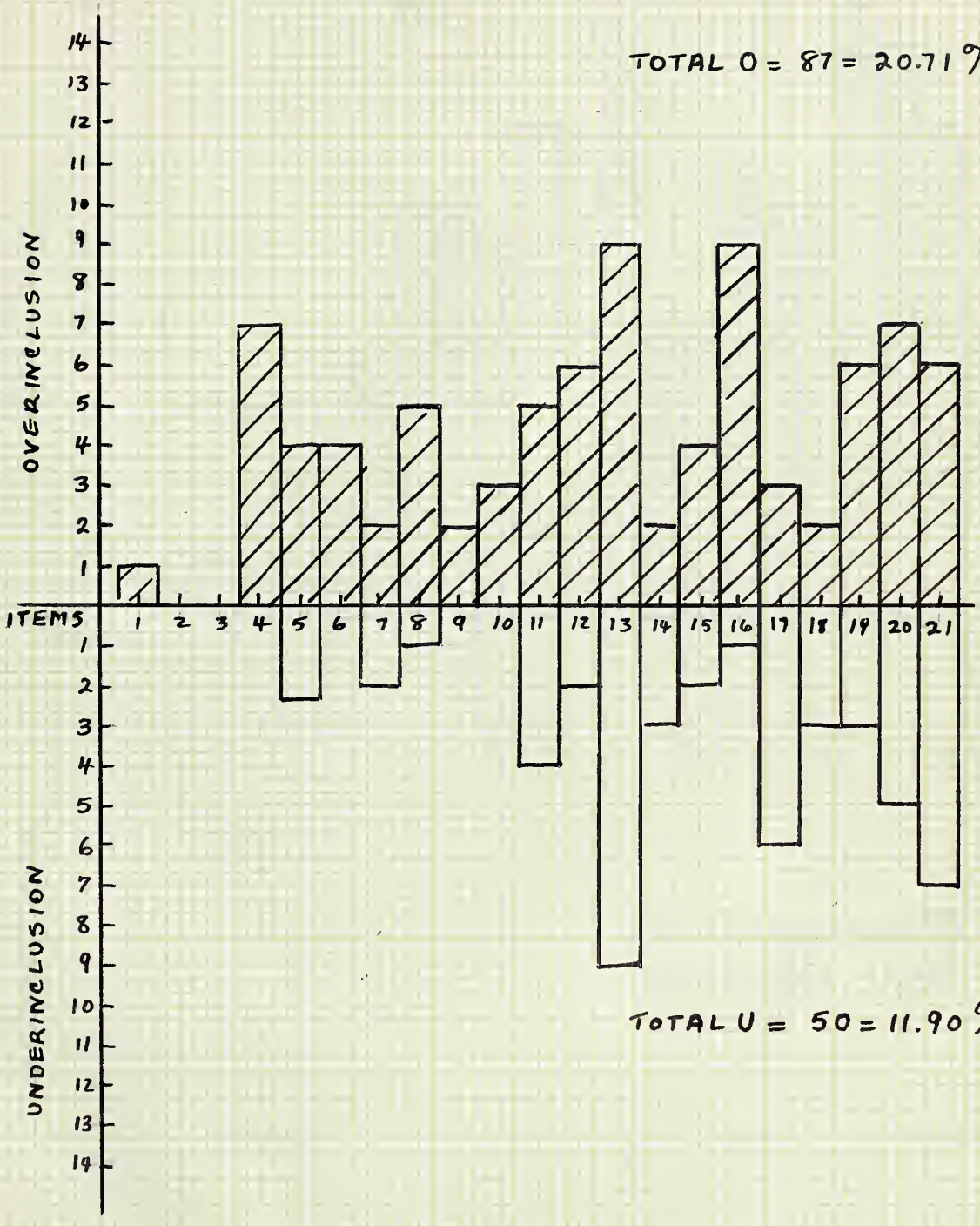
DISTRIBUTION OF ITEM FAILURES
GROUP I - NORMALS

FIGURE 3



DISTRIBUTION OF ITEM FAILURES
GROUP II - PATHOLOGICAL PERSONALITIES

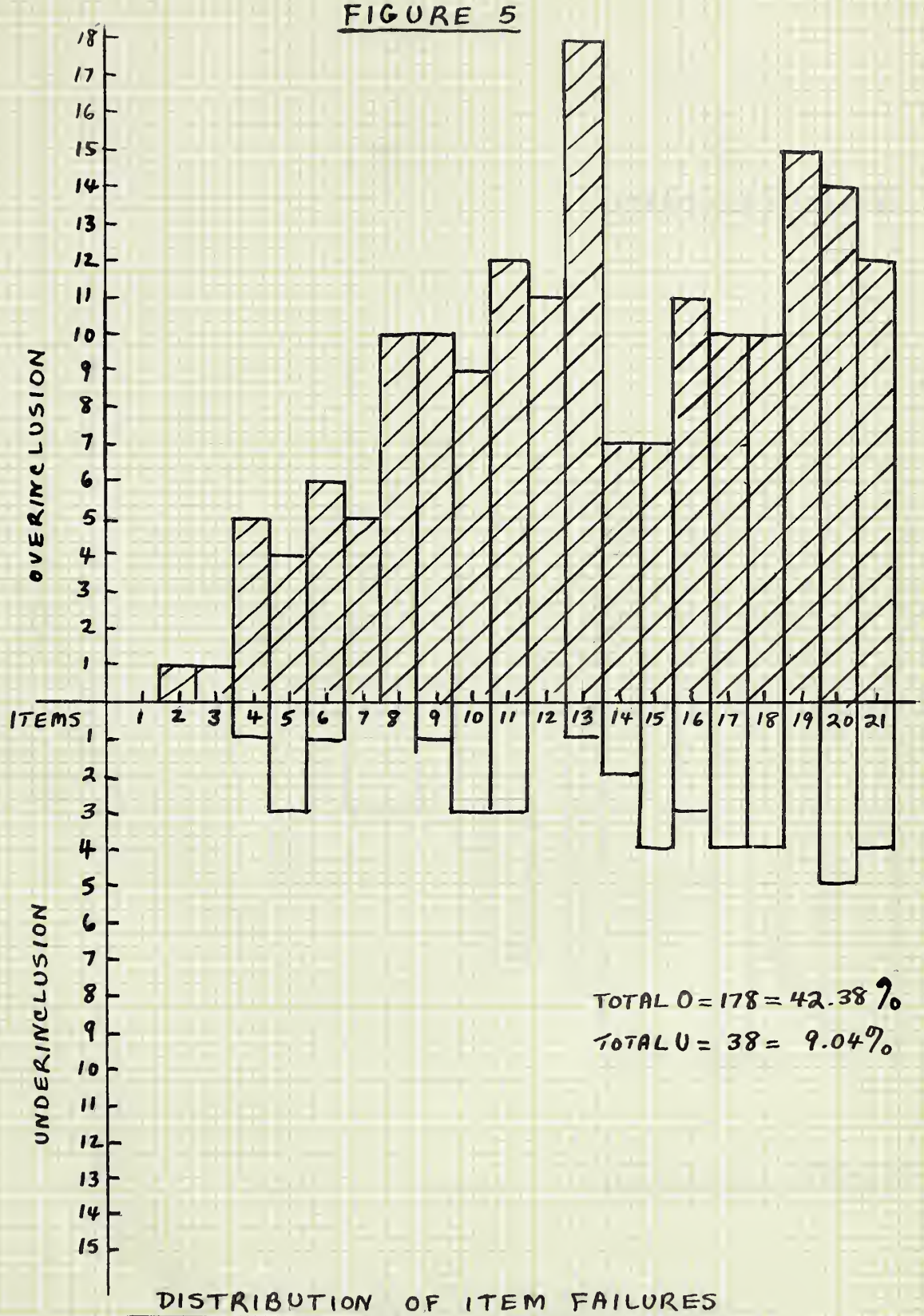
FIGURE 4



DISTRIBUTION OF ITEM FAILURES

GROUP III - PSYCHONEUROTICS

FIGURE 5



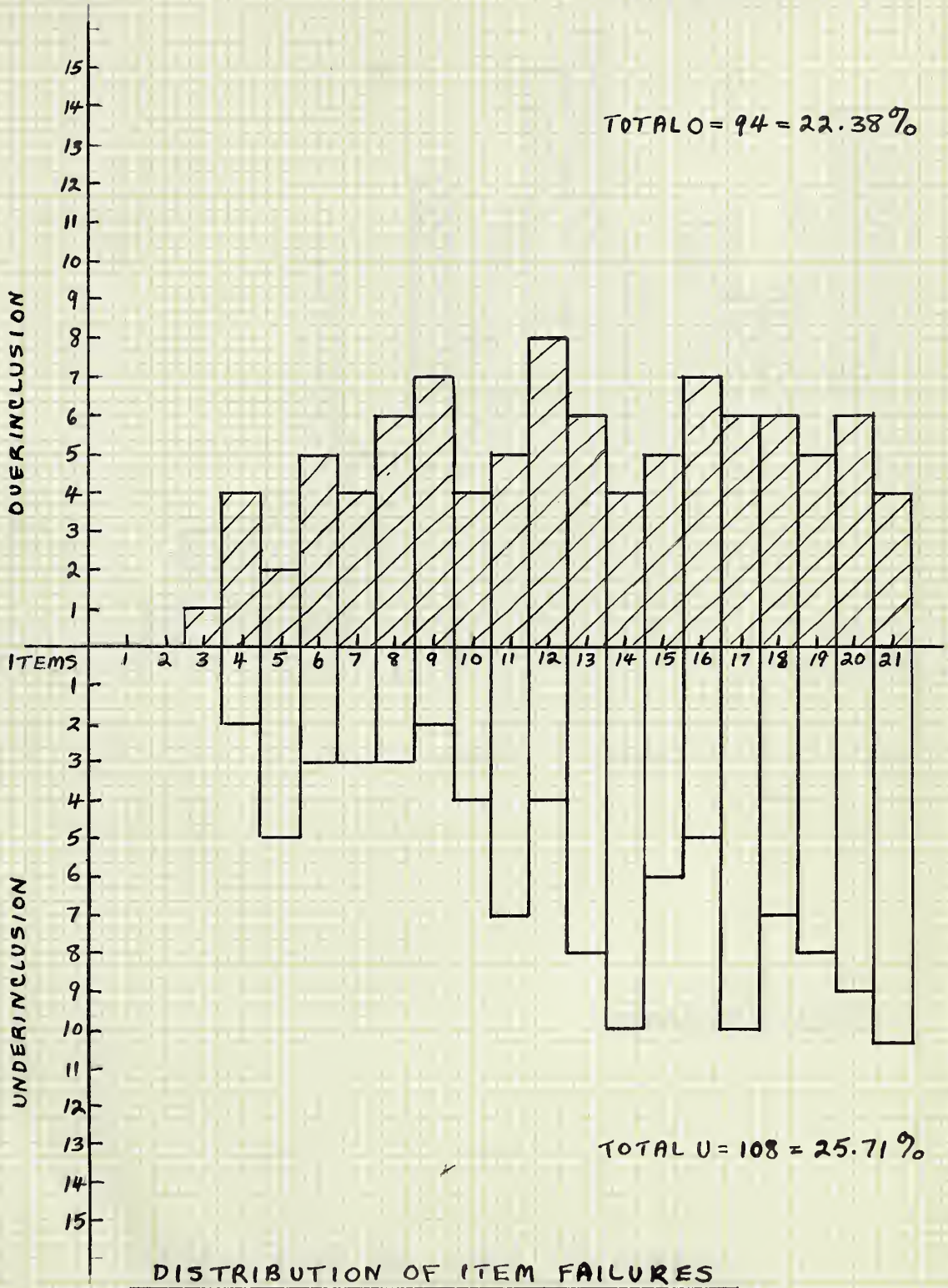
TOTAL O = 178 = 42.38 %

TOTAL U = 38 = 9.04 %

DISTRIBUTION OF ITEM FAILURES

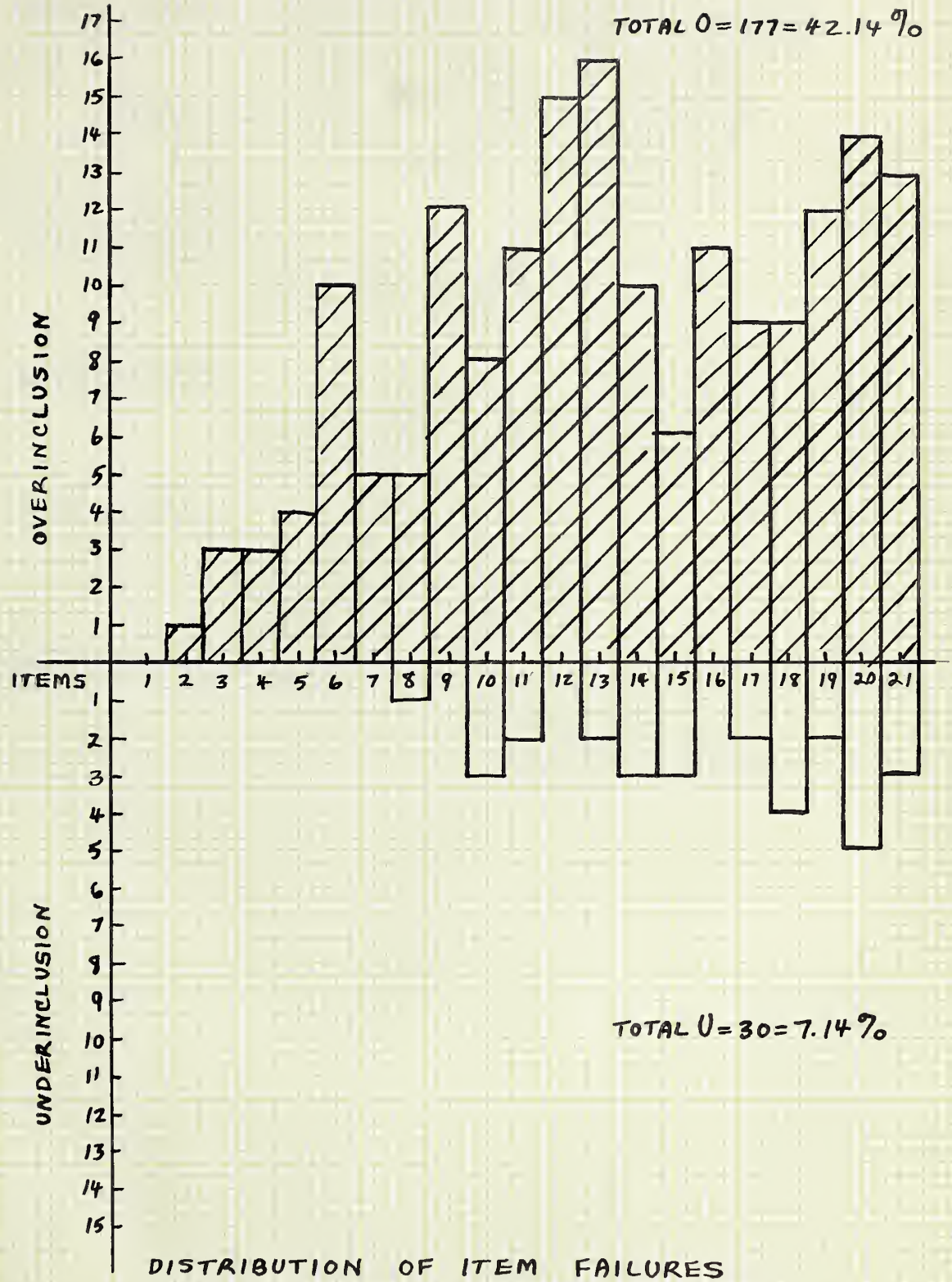
GROUP IV - SCHIZOPHRENIA, CATATONIC

FIGURE 6



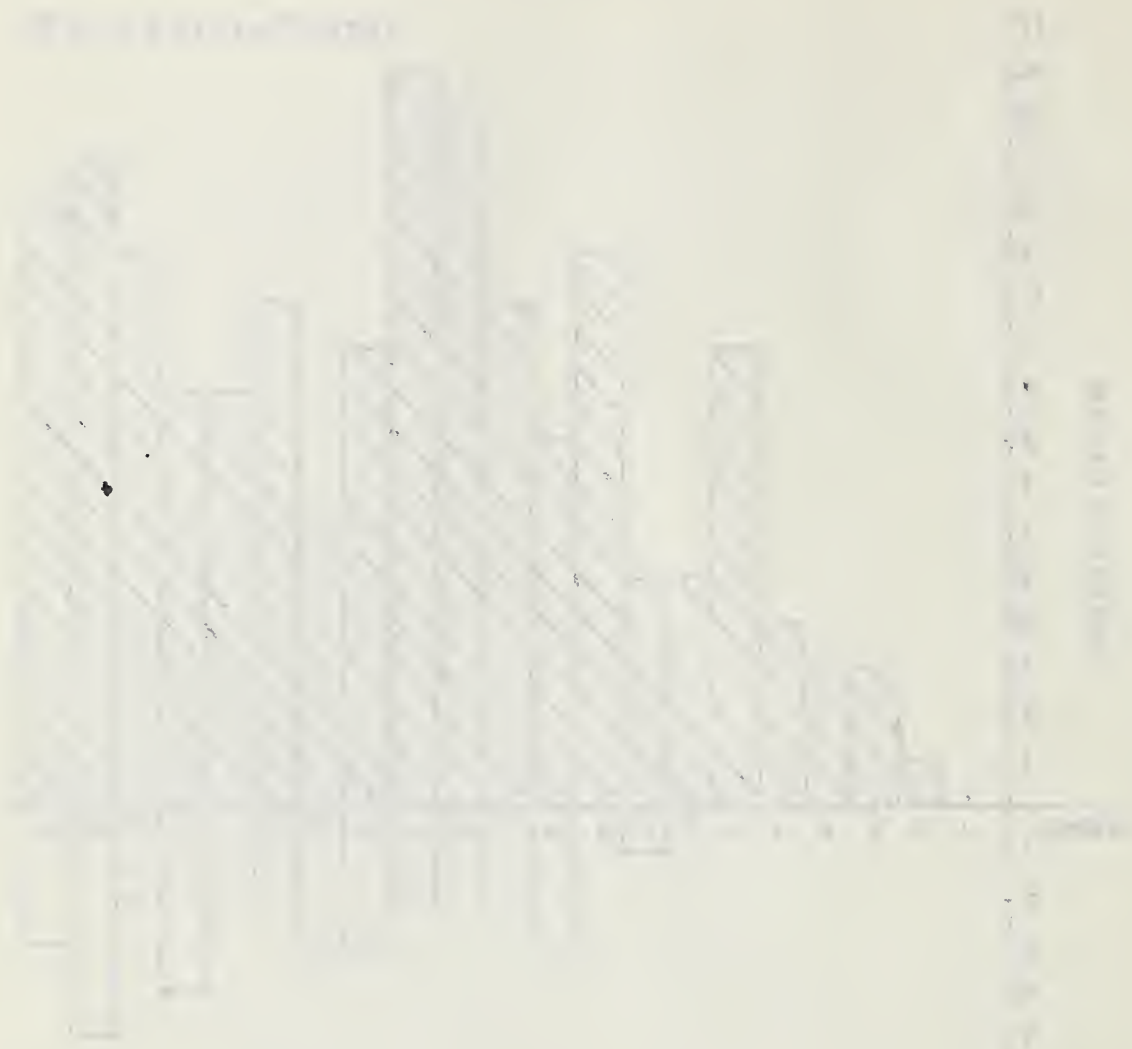
DISTRIBUTION OF ITEM FAILURES
GROUP V - SCHIZOPHRENIA, PARANOID

FIGURE 7



DISTRIBUTION OF ITEM FAILURES

GROUP VI – SCHIZOPHRENIA – UNDEFINED



Appendix D (i)

One-Way Analysis of Variance of Overinclusion Errors

Formula:

$$E(s_b^2) = \sigma^2 + \frac{\sum_{j=1}^{K} (u_j - u)^2}{K-1} \left(\frac{N - \sum_{j=1}^{K} n_j^2 / N}{K-1} \right)$$

Computation Formulas:

Between Groups:

$$\sum_{j=1}^{K} \left(\frac{T_j^2}{n_j} \right) - \frac{T^2}{N}$$

Within Groups:

$$\sum_{j=1}^{K} \sum_{i=1}^{n_j} X_{ij}^2 - \sum_{j=1}^{K} \left(\frac{T_j^2}{n_j} \right)$$

Total Groups:

$$\sum_{j=1}^{K} \sum_{i=1}^{n_j} X_{ij}^2 - \frac{T^2}{N}$$

Comparison of means formula:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{S\omega^2/n_1 + S\omega^2/n_2}}$$

Analysis of Variance; One-Way Classification Number of Overinclusion Errors

I	I (contd)	II	III	IV	V	VI
8	4	11	8	14	11	16
8	3	9	7	14	11	14
8	3	9	7	13	11	13
7	3	7	7	12	8	12
7	3	7	7	11	6	12
6	3	5	6	11	6	12
6	3	5	6	11	6	10
6	2	5	5	10	6	10
6	2	4	5	10	5	9
6	2	4	5	9	5	9
6	2	4	4	9	5	8
6	1	4	4	9	4	8
6	1	4	3	8	4	8
5	0	3	3	8	3	8
5	0	2	3	6	3	7
5	0	1	3	6	0	5
4	0	0	2	6	0	5
4	0	0	1	5	0	5
4	0	0	1	4	0	4
4	0	0	0	2	0	2

	I	II	III	IV	V	VI	
N_j	40	20	20	20	20	20	N 140
T_j	149	84	87	178	94	177	T 769
$\bar{X}_j$	3.73	4.20	4.35	8.90	4.70	8.85	T /N
$\sum_{i=1}^{n_j} X_{ij}^2$	793	550	481	1792	696	1815	
$\frac{T_j^2}{n_j}$	555.03	352.45	378.45	1584.20	441.80	1566.45	

$T^2/N = 4224.01$

$\sum_{j=1}^{k} \sum_{i=1}^{n_j} X_{ij}^2 = 6127$

$\sum_{j=1}^{k} \frac{T_j^2}{n_j} = 4878.73$

Sum of Squares		
Between	4878.73 - 4224.01	654.72
Within	6127.00 - 4878.73	1248.27
Total	6127.00 - 4224.01	1902.99

Source of Variation	Sum of Squares	Degrees of Freedom	Variance Estimate
Between	654.72	5	130.94 = Sb^2
Within	1248.27	134	9.32 = Sw^2
TOTAL	1902.99	139	F = 14.05

Value of F required for significance at .01 level (when $\frac{df\ 5}{df\ 134}$) is 3.17. Null hypothesis is rejected.

Example of Comparison of Means Two at a time ("t" Test)

Groups I, II: $\frac{4.20 - 3.73}{\sqrt{\frac{9.32}{40} + \frac{9.32}{20}}} = \frac{.47}{\sqrt{.208 + .466}} = \frac{.47}{\sqrt{.674}} = \frac{.47}{.8185} = .574$

Summary of Significant Ratios

Comparison of Groups	Degrees of Freedom	"t" Ratio	Level of Significance
Groups I, II	134	.574	NS
Groups I, III	134	.757	NS
Groups I, IV	134	6.32	$p < .001$
Groups I, V	134	1.19	NS
Groups I, VI	134	6.26	$p < .001$
Groups II, III	134	1.55	NS
Groups II, IV	134	4.87	$p < .001$
Groups II, V	134	.518	NS
Groups II, VI	134	4.82	$p < .001$
Groups III, IV	134	4.72	$p < .001$
Groups III, V	134	3.73	NS
Groups III, VI	134	4.66	$p < .001$
Groups IV, V	134	4.35	$p < .001$
Groups IV, VI	134	.005	NS
Groups V, VI	134	4.30	$p < .001$

Appendix D (ii)

Procedure for Kruskal - Wallis One-Way Analysis of Variance (by Ranks) of Underinclusion Errors

Formula: $$H = \frac{\frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{Rj^2}{nj} - 3(N+1)}{1 - \frac{\Sigma T}{N^3 - N}}$$

Table of Underinclusion Ranks

Group I		Group I contd.		Group II		Group III		Group IV		Group V		Group VI	
9	135.5	1	60.5	7	130.5	8	133.0	5	117.5	13	140.0	8	133.0
7	130.5	1	60.5	5	117.5	6	126.0	5	117.5	11	139.0	6	126.0
6	126.0	1	60.5	4	108.0	6	126.0	4	108.0	10	137.5	4	108.0
5	117.5	0	24.0	4	108.0	6	126.0	3	96.5	10	137.5	2	81.5
5	117.5	0	24.0	4	108.0	5	117.5	3	96.5	9	135.5	2	81.5
4	108.0	0	24.0	3	96.5	5	117.5	3	96.5	8	133.0	2	81.5
4	108.0	0	24.0	3	96.5	3	96.5	3	96.5	6	126.0	1	60.5
3	96.5	0	24.0	2	81.5	3	96.5	3	96.5	6	126.0	1	60.5
2	81.5	0	24.0	2	81.5	3	96.5	2	81.5	5	117.5	1	60.5
2	81.5	0	24.0	2	81.5	2	81.5	2	81.5	5	117.5	1	60.5
2	81.5	0	24.0	1	60.5	2	81.5	1	60.5	5	117.5	1	60.5
2	81.5	0	24.0	1	60.5	1	60.5	1	60.5	4	108.0	1	60.5
2	81.5	0	24.0	1	60.5	0	24.0	1	60.5	4	108.0	0	24.0
1	60.5	0	24.0	0	24.0	0	24.0	1	60.5	3	96.5	0	24.0
1	60.5	0	24.0	0	24.0	0	24.0	1	60.5	3	96.5	0	24.0
1	60.5	0	24.0	0	24.0	0	24.0	0	24.0	3	96.5	0	24.0
1	60.5	0	24.0	0	24.0	0	24.0	0	24.0	2	81.5	0	24.0
1	60.5	0	24.0	0	24.0	0	24.0	0	24.0	1	60.5	0	24.0
1	60.5	0	24.0	0	24.0	0	24.0	0	24.0	0	24.0	0	24.0
1	60.5	0	24.0	0	24.0	0	24.0	0	24.0	0	24.0	0	24.0
		$n_1 = 40$		$n_2 = 20$		$n_3 = 20$		$n_4 = 20$		$n_5 = 20$		$n_6 = 20$	
		$R_1 =$	2360.0	$R_2 =$	1359.0	$R_3 =$	1451.0	$R_4 =$	1411.0	$R_5 =$	2122.5	$R_6 =$	1166.5

Correction for Ties:

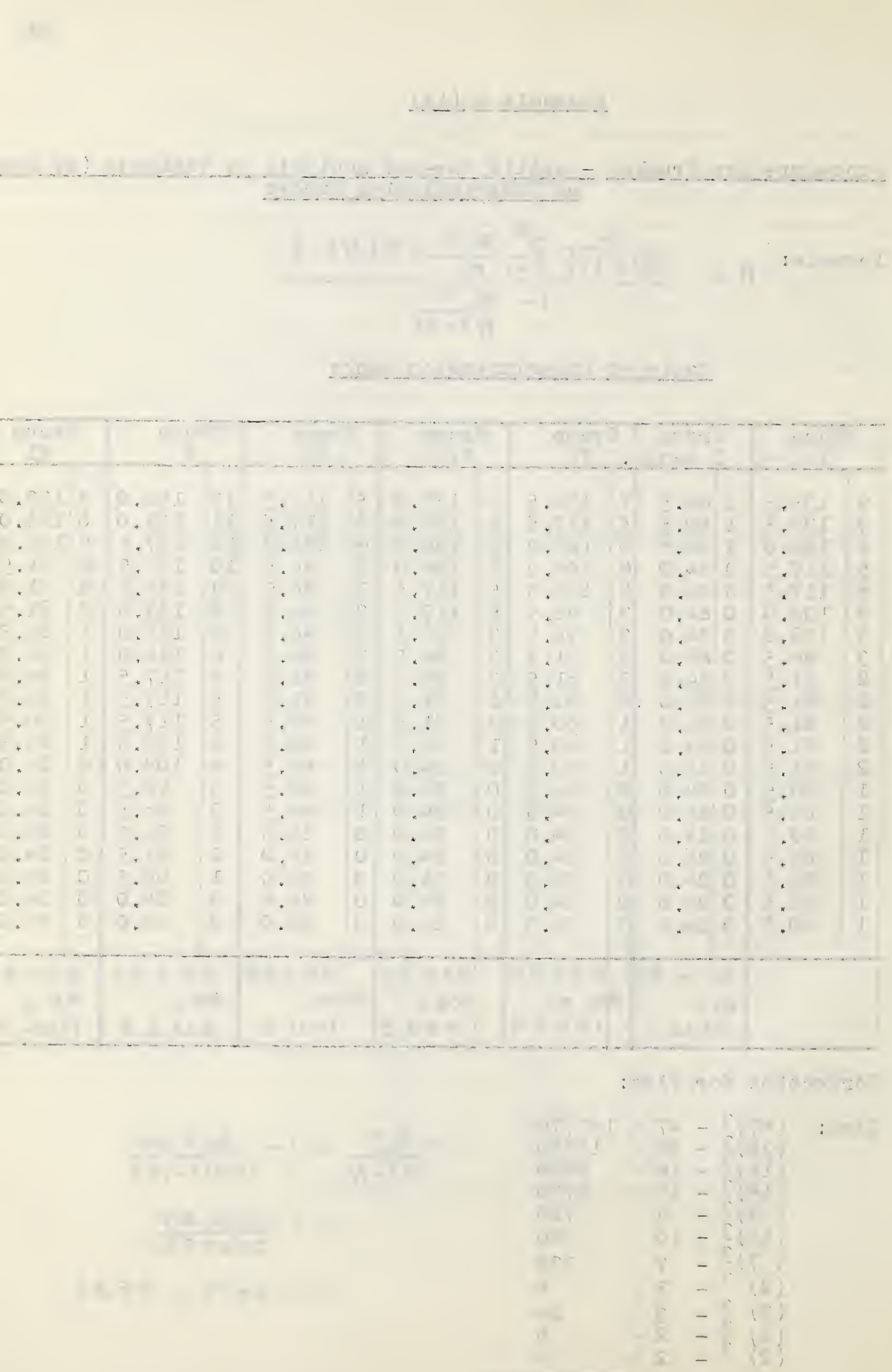
Ties:
$(47)^3 - 47 = 103776$
$(26)^3 - 26 = 17550$
$(16)^3 - 16 = 4080$
$(14)^3 - 14 = 2730$
$(9)^3 - 9 = 720$
$(10)^3 - 10 = 990$
$(7)^3 - 7 = 336$
$(2)^3 - 2 = 6$
$(3)^3 - 3 = 24$
$(2)^3 - 2 = 6$
$(2)^3 - 2 = 6$

$\Sigma T = 130224$

$$1 - \frac{\Sigma T}{N^3 - N} = 1 - \frac{130224}{(140)^3 - 140}$$

$$= 1 - \frac{1302.24}{2743860}$$

$$= 1 - .0475 = .9525$$



Value of H: $H = \frac{12}{140(140+1)}\left[\frac{(2360.0)^2}{40}+\frac{(1359.0)^2}{20}+\frac{(1451.0)^2}{20}+\frac{(1411.0)^2}{20}+\frac{(2122.5)^2}{20}+\frac{(1166.5)^2}{20}\right]-3(140+1)$

$H = \frac{.000007\,[729686]-423}{.9525} = \frac{19.915}{.9525} = 20.912$

The probability under Ho of a value as large as H 20.912, df 5, is $p < .001$.

Example of Method of Comparing Groups Two at a Time

Group I				Group II	
9	60.9	1	31.0	7	58.5
7	58.5	1	31.0	5	55.0
6	57.0	1	31.0	4	51.0
5	55.0	0	12.5	4	51.0
5	55.0	0	12.5	4	51.0
4	51.0	0	12.5	3	47.0
4	51.0	0	12.5	3	47.0
3	47.0	0	12.5	2	41.5
2	41.5	0	12.5	2	41.5
2	41.5	0	12.5	2	41.5
2	41.5	0	12.5	1	31.0
2	41.5	0	12.5	1	31.0
2	41.5	0	12.5	1	31.0
1	31.0	0	12.5	0	12.5
1	31.0	0	12.5	0	12.5
1	31.0	0	12.5	0	12.5
1	31.0	0	12.5	0	12.5
1	31.0	0	12.5	0	12.5
1	31.0	0	12.5	0	12.5
1	31.0	0	12.5	0	12.5
$n1 = 40$ $R1 = 1164.5$				$n2 = 20$ $R2 = 665.5$	

Correction for Ties:

$1 - \frac{17238}{215940} = .9202$

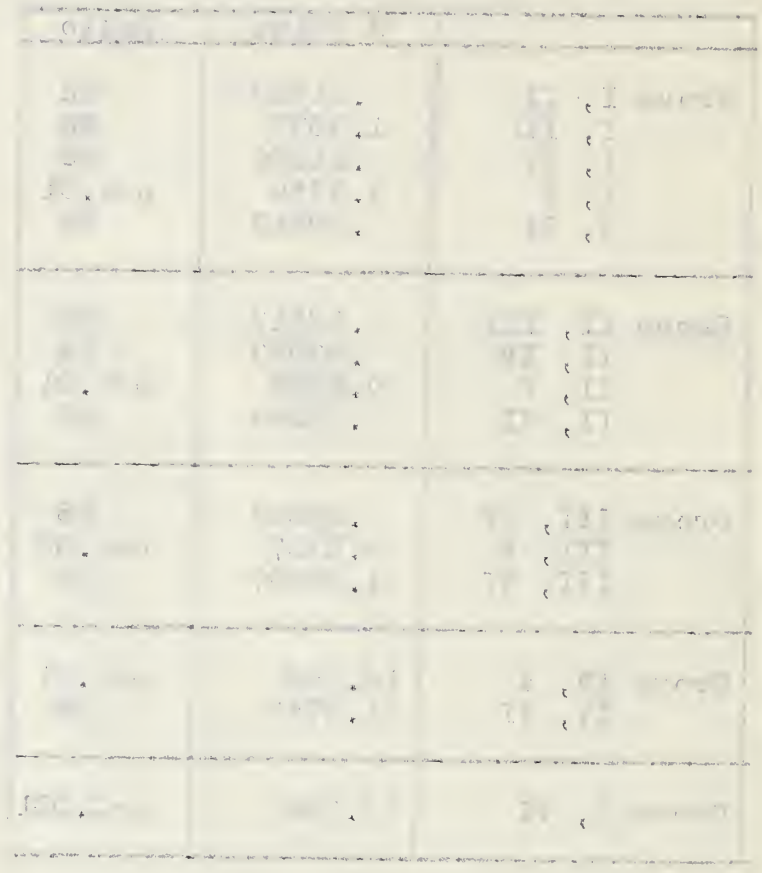
$H = .0032786\left[\frac{(1164.5)^2}{40}+\frac{(665.5)^2}{20}\right]-183$

$= .0032786\,[56045.5] - 183$

$= .81588$

H Values and Critical Values (Chi Square) of Groups Compared Two at a time, with One Degree of Freedom

	H Value	Ratio
Group I, II	.81588	NS
I, III	1.3033	NS
I, IV	.61009	NS
I, V	9.9554	$p < .01$
I, VI	.00013	NS
Group II, III	.18517	NS
II, IV	.03083	NS
II, V	9.9389	$p < .01$
II, VI	.75244	NS
Group III, IV	.09089	NS
III, V	6.2707	$p < .02$
III, VI	1.02097	NS
Group IV, V	10.562	$p < .01$
IV, VI	1.4753	NS
Group V, VI	12.340	$p < .001$



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